THE INLAND ARCHITECT AND NEWS RECORD

Vol. XXXIV. JANUARY, 1900. No. 6

THE INLAND ARCHITECT AND NEWS RECORD

A Monthly Journal Devoted to

ARCHITECTURE,

CONSTRUCTION, DECORATION AND FURNISHING

IN THE WEST.

PUBLISHED BY THE INLAND PUBLISHING CO.,

609-610 MANHATTAN BUILDING, CHICAGO, ILL.

L. MULLER, Jr., Manager. ROBERT CRAIK McLEAN, Editor.

SPECIAL CONTRIBUTORS:

DANKMAR ADLER,	D. H. BURNHAM,	W. L. B. JENNEY,
HENRY VAN BRUNT,	P. B. WIGHT,	IRVING K. POND,
LOUIS H. SULLIVAN,	ALLEN B. POND,	J. R. WILLETT,
WILLIAM S. MACHARG.	C. E. ILLSLEY.	F. W. FITZPATRICK.

TERMS: Regular number, $5 a year; Photogravure edition, $10 a year. Single copies, Regular number, 50c.; Photogravure edition (including 7 photogravures), $1. Advance payment required.

The columns and illustration pages of THE INLAND ARCHITECT are open to all alike, merit and availability only determining what shall be published. Contributions appropriate to its pages are always desired.

AMERICAN INSTITUTE OF ARCHITECTS.

OFFICERS FOR 1900:

PRESIDENT	*ROBERT S. PEABODY, Boston, Mass.
SECRETARY AND TREASURER	*GLENN BROWN, Washington, D. C.
FIRST VICE-PRESIDENT .	*FRANK MILES DAY, Philadelphia, Pa.
SECOND VICE-PRESIDENT .	WILLIAM S. EAMES, St. Louis, Mo.
AUDITOR FOR TWO YEARS .	S. A. TREAT, Chicago, Ill.
AUDITOR FOR ONE YEAR .	E. H. KENDALL, New York, N. Y.

BOARD OF DIRECTORS:

For three years.—Henry Van Brunt, Kansas City, Mo.; James B. Hill, Washington, D. C.; Normand S. Patton, Chicago, Ill.

For two years.—Arthur G. Everett, Boston, Mass.; George B. Post, New York City; Alfred Stone, Providence, R. I.

For one year.—Robert W. Gibson, New York City; Levi T. Scofield, Cleveland, Ohio; W. M. Poindexter, Washington, D. C.

*Executive Committee.

STANDING COMMITTEES FOR 1900:

Judiciary Committee.—George B. Post, New York City; Alfred Stone, Providence, R. I.; Levi T. Scofield, Cleveland, Ohio.

House and Library Committee.—Robert Stead, Washington, D. C.; Glenn Brown, Washington, D. C.; Frank Miles Day, Philadelphia, Pa.

Education and Publication Committee.—H. L. Warren, Boston, Mass.; William R. Ware, New York City; W. P. Laird, Philadelphia, Pa.; Glenn Brown, Washington, D. C.; N. Clifford Ricker, Urbana, Ill.; Cass Gilbert, St. Paul, Minn.; F. W. Chandler, Boston, Mass.

Committee on Foreign Correspondence.—John M. Carrère, New York City; R. W. Gibson, New York City; T. C. Link, St. Louis, Mo.; Edgar V. Seeler, Philadelphia, Pa.

Committee on Contracts and Lien Laws.—R. D. Andrews, Boston, Mass.; Alfred Stone, Providence, R. I.; E. H. Kendall, New York City.

Committee on Applied Arts and Sciences.—George B. Post, New York City; D. Adler, Chicago, Ill.; F. E. Kidder, Denver, Colo.

Legislative Committee on Government Architecture.—George B. Post, chairman. Committee—Bruce Price, New York City; John M. Carrère, New York City; James G. Hill, Washington; Alfred Stone, Providence. Alternates—Edward H. Kendall, New York City; H. J. Hardenbergh, New York City; Robert Stead, Washington; R. S. Peabody, Boston.

Delegate to National Conference on Standard Electrical Rules.—Alfred Stone, Providence, R. I.

C. H. Walker's European Municipal Investigations.

Probably the most important ethical subject before the American people today is that which has been broadly called "municipal improvement," but which means the intelligent control of all structural or ornamental building in cities. This has long been urged by architects and artists, but until recently has received little or no attention from the public at large. To arrive at a better understanding of the many ways in which the harmony of street fronts and vistas may be preserved, as well as to demonstrate the course older countries have pursued, some of them for generations, Mr. C. Howard Walker is making a tour of Europe and studying the problem in all its various forms, in order that he may, on his return, intelligently and authoritatively discuss and urge upon the cities in the United States the importance and benefit of similar laws. In this second of the series of papers which we are publishing on the subject, Mr. Walker has outlined the conditions and regulations existing in European cities, and his investigations can not but excite thought in this direction in a country like ours, where the opportunities are so great and the results so certain. It seems almost an evidence of barbarism that where so much wealth is distributed in building throughout our great cities that so little regard is given to the ensemble and the utter disregard for everything that gives symmetry as a whole. It is true that the public has become fairly well educated in the direction of "good architecture," but incongruous surroundings have destroyed much that the individual structure would otherwise have enhanced. Mr. Walker's mission is therefore one of national interest and purport, and his high standing as an architect and writer should give to his investigations and deductions definite results in the line of laws governing municipal buildings and their enforcement. The general government should also go a step farther in the direction of reform so auspiciously inaugurated by Secretary Gage in the establishment of the Tarsney law, and, in the selection of sites, study their relationship to surroundings and use its influence with the State and municipal authorities.

A Supreme Court Sustains High Building Law.

The Supreme Court of Massachusetts in a decision lately rendered has sustained the constitutionality of an act limiting the height of buildings in a part of the city of Boston. The position taken by the court is that "It is purpresture, which, while not in a strict and narrow sense a public nuisance, is in the nature of a public nuisance, is sometimes called a public nuisance, and in equity is to be dealt with as a public nuisance." This is better than trying to prove that high buildings are unsightly or unsanitary or an infringement upon the rights of adjoining property owners. It means all these and establishes a precedent. If the "improvement" of parks and the erection of unsightly monuments can be regulated and restrained, or on the contrary where the selfish objection of an adjoining property owner to an evident improvement can be overruled, it will remove one of the principal drawbacks to national advancement on artistic and economic lines.

MUNICIPAL LAWS IN RELATION TO ARCHITECTURE.

BY C. HOWARD WALKER.

THE question of municipal or governmental interference or control in matters of art and architecture is receiving serious consideration upon all sides — not only because of esthetic desires, but because it has become fairly apparent that there is a closer connection between the attractiveness of a city and its prosperity than has been previously acknowledged. The conditions seem to be coincident or at least supplementary to each other. Material prosperity is accompanied by civic pride, and the resultant embellishment of the city attracts in its turn and produces still greater prosperity. Under the conditions of the past, growth was gradual and changes intermittent, the fine arts developed progressively step by step, and while periods of apogee existed, both the rise and fall of each style or of each school was regular, consistent and localized. Limitations of space, of lack of intercourse and of transportation and consequent concentration of energy tended to individualize the art of each city, and to make it little subject to fickle variations — and each phase of art developed its own laws, which were the outgrowth of the local conditions, and which were either inapplicable or unsatisfactory elsewhere.

All this has been entirely changed, and modern conditions, under which art can develop, are so absolutely free and unfettered that there seems to be but little structure upon which an art can be raised. Let us compare, for instance, the achievement of any of the periods of great architecture up to the beginning of the present half century with the possibilities of the architecture of today. In most cases, religious observances, which were dogmatic in their requirements, set a style and method of construction from which a style formed. This in its turn was refined by successive generations and took on such marked characteristics that any attempt at radical change was evidently no improvement, and variations caused by new requirements were so manifestly related to the parent style that any restraint excepting that of good taste seemed unnecessary.

The height of buildings was determined by the limit of man's desire to climb, the quality of design by the gradual inheritance of good taste born of constant association with true construction, simple forms and refined expression. No restraint was put upon architectural expression, because it made a law unto itself, based upon direct traditionary descent of the arts. Today all restraint is removed, traditions are unrespected and unconceived, construction is filled with new and experimental elements, and there is absolutely no limit to the possibilities of architectural development in every direction. The first impulse is to assume that such conditions are the most advantageous possible, that they are stimulating, novel and encouraging, and that the architecture of the future, the ideal, the masterful achievement will be produced by this liberty of action and abundance of material. But the fact remains that boundless horizons belittle whatever they surround, that unlimited possibilities paralyze action, and that the concentration of thought and effort of the past becomes a thin mist of diffused experiments when left to confront the possibilities of the present.

If, therefore, the very lack of restaint of today is a positive disadvantage in the development of good architecture in our cities, is it not a rational consequence that we should apply certain laws which would minimize eccentricity, and as far as possible prevent incongruity in our city architecture? And if so, what shall be the character of such laws and upon what shall they be based? Any coercion in the matter of styles or character of building is manifestly unjustifiable and of no value. Any and all styles of architecture can be made harmonious. Any regulation of methods of construction other than that they shall be secure is equally unjust. All limitations as to kind of material would be merely autocratic and unreasonable. There remain, then, two factors in architecture or in building, upon one or both of which these controlling laws should be built — first, possible injury to neighboring estates; second, injury to general or public welfare. As to an appeal to public taste, it is of little value, as has been abundantly proved when such taste has been uninfluenced by the environment of works of art by great masters. All education must begin with the few and be taken up by the many.

In all matters of material welfare, the material relations of neighbors is carefully considered and each is protected — encroachment or injury of any kind being rigorously punished — but it is acknowledgedly difficult to always define where material conditions cease. Is disproportion and incongruity of design no material injury? and, even more, is excessive height and consequent shade no material injury? In the latter case, such statistics as exist proclaim actual though indefinite injury, while in the former it is none the less actual but incapable of proof. As to the matter of still greater importance — the general welfare of a city — it is apparent that the beauty of a city is a marked pecuniary asset. One has only to realize the vast amounts of money spent by the traveling public to appreciate the fact that the public goes where it will find the fine arts at their best.

Consideration of controlling laws in the matter of architecture is therefore of selfish expediency, if all nobler arguments fail — both to the individual and to the public at large. In order to determine the exact character of such laws, we must first establish the injuries which occur from their lack, and compare various local conditions for suggestions as to methods of procedure in each case.

Laws governing the erection of buildings in relation to their architectural effect are existent and recognized in European cities, and have been in force in France for over one hundred years. In each case, new laws have been enacted at the time of a marked change in the government, thus indicating a general interest in such matters and a desire on the part of each new power to improve upon the acts of its predecessors. These laws are mainly of two kinds: First, those relating to the height of buildings; second, those relating to the size of interior courts. Both are primarily laws compelling sufficient light and air, and enacted ostensibly, and possibly actually, for sanitary reasons, and forced upon European cities by repeated difficulties in stamping out disease and in keeping streets dry and clean. But — and this is of interest — both sets of laws have immediately tended to beautify the cities, the first by preventing great incongruities of skylines, the second by compelling broad façades. This latter requires a little explanation. In European cities — Paris, for instance — the height of walls is proportional up to a certain point (say, twenty meters) to the width of the street or court upon which they occur; an interior wall, therefore, to be of any considerable height, must be upon a good-sized court, which, in its turn, requires a building of ample width and therefore of broad façade. These laws in regard to courts are in force in Berlin, Dresden, Vienna, Buda Pesth, Paris and elsewhere.

In London, however, the laws are somewhat different. There, as in American cities, there are streets of small individual holdings, and there is much less living in apartments than upon the continent. Such streets are necessarily a succession of narrow fronts, each of which the occupant desires to make as individual as possible. The effect is necessarily of a harlequin order of architecture. The same difficulty is to be found in each of our American cities. In London, at the time of Nash, there was an attempt made to unite these various fronts into one long façade, but the persistent individuality appeared in variously colored doors and shutters and different shades of paint.

The apartment house, on the other hand, while distinctly more effective than the united house fronts, has many practical disadvantages. The very gregariousness of the occupants of apartment houses leads to dangers from diseases, etc., from which the small house occupant is free. And it is doubtful if the English-speaking peoples will ever abandon their own small castles. Still, the value of land in the centers of large cities tends to the amalgamation of small holdings and the erection of large buildings, and, therefore, the European laws, both in regard to height of buildings and to courts, are applicable to the centers of all large American cities.

There is a minor set of laws, which, while seemingly slight, have done much to enhance the beauty of Paris, and each of these has as its motive a desire for improvement in appearance. First, no signs are allowed excepting of gold skeleton letters above the ground floor, and, therefore, all architectural lines are undisturbed. Second, no chimneys shall set on front wall, nor on party or side walls within a given number of feet of front wall; this insures integrity of skyline of cornice. Third, cornice and belt lines in same block shall be made to harmonize; this produces a larger effect of mass and scale than would occur with adjacent unrelated façades, however long.

It will be noticed that these laws are either caused by sanitary requirements, in which case it would be suicidal to oppose them,

or they are of so apparently slight a nature that it does not seem worth while to make objections to them, yet their effect has been very remarkable upon the architecture of European cities.

As to specific laws in regard to the height of buildings, they must necessarily be influenced by local conditions. For instance, in a city restricted from expansion in all directions but one, as in New York, high buildings are more justifiable than elsewhere — but there is a reasonable limit which is finally determined by circumstances, even in such a case. In most instances, however, the experience of the older and more conservative cities of the world is suggestive. A height of sixty or seventy feet of wall has been found to be equitable and lucrative in return; more than this immediately creates conditions which are either inimical to the property itself or to that adjacent. Therefore some such limit would seem advisable.

The existence of small holdings is constantly an obstacle to the proper and economical development of properties, and it has repeatedly been shown that better planning, and consequently better and more economical buildings in every respect can be applied to large lots than to a number of small lots, the aggregate of which would be one large lot. Especially is this true for business buildings and for apartments. For all public buildings it is an absolute necessity. Therefore any law which will encourage large instead of small façades is a positive advantage.

This brings up the point of foresight in the planning of new portions of cities, in the laying out of new streets, the sequestration of property for public purposes, etc., all of which have been notably neglected in American cities. Abroad there is in each city a set of officials whose duty it is to see that public buildings shall be adequate both in efficiency and design; that they shall be well placed, well surrounded and well maintained. It seems absurd to be obliged to advocate the establishment of boards or commissions of such officials in American cities, but they are sadly needed. With the exception of isolated and infrequent art commissions and village improvement societies, no such departments for the care of city development exist. Buildings are placed in expedient — not in selected — positions, and are in most cases meanly surrounded and with inadequate approaches. City halls, public libraries, schoolhouses, etc., merely occur, certainly in but few cases are carefully considered as to site. No provision is made for the effective grouping of important buildings; each is isolated and unrelated to anything about it, and this negligence is the more inexcusable as there is the example of the cities of every other country excepting the United States constantly manifest — new cities as well as old — for nowhere has more care been taken in placing public buildings than in Vienna and in Buda-Pesth. In the former advantage was taken of the space occupied by the old city walls to lay out the magnificent Ring Strasse, upon which every vista has its axial monument or building; and in the latter the banks of the Danube have been nobly treated, and the great boulevards, such as the Andrassy Uitcza, are a long vista of fine façades, each of 150 or 200 feet frontage. No high buildings have been permitted in these cities; no bare party walls without a window and of different material from the façades are to be seen; little, if any, incongruous masses of building are to be found. Everything is well considered, carefully proposed and adequately carried out, and the result is that after a sojourn in cities of this character the crudeness and vulgarity of the average American city is intolerable. Yet there are individual buildings in America of great merit, and they are not few in number, but they are lost in the general heterogeneous collection of experiments. With us it is not liberty of action, but the license of ignorance and thoughtlessness, and can only be corrected and overcome by the intelligent control of laws similar to those cities.

In relation to specific laws for municipal improvements — those of Paris are perhaps the most suggestive — and have been already mentioned. The following foreign cities have definite laws:

London.— The laws are very voluminous and in many cases contradictory, and are severely criticised by architects for that reason. No high buildings are allowed, however. The general tendency of the architecture in the more dense portions of London is toward constantly increasing size of ground plan. There is a city council which controls all prospective and actual laying out of streets, creation of monuments, etc., and which has upon it men of ability and distinction.

Berlin.— Municipal improvements are largely influenced by the Imperial Government's desires. There is a board of control which has experts upon it appointed for their knowledge and merit.

Vienna.— Similar to Berlin.

Buda-Pesth.— Similar to Berlin.

Munich and Dresden.— Each under governmental control, with commissions appointed from eminent men.

Italian cities each have their Societa of Arts, which strongly influence the character of the work in each city, and all of which are under government supervision.

French cities frame their art departments upon that of Paris, where all important buildings and monuments must receive the approval of a special department with an accomplished architect as its chief factor.

In all cases it has been long recognized that it is most unwise to allow cities to grow at the mere caprice of private individuals without a consulting and advisory intelligent factor at hand. In mediæval times such a factor was supplied by the patrons of the arts who were the best educated men of their time, or by the chiefs of the monastic orders, who were also men of cultivation. In modern times these elements have been replaced by commissions of authority, composed of artists, architects and men of culture, in whose hands the welfare of the public could be placed. In but few cases has this confidence been abused — and certainly no more reasonable method could be desired for obtaining the best results and for checking sporadic cases of eccentricity.

CHICAGO NATIONAL BANK BUILDING COMPETITION.

THIS competition, by invitation, was open to a number of Chicago architects. The following submitted designs: S. S. Beman, Jenney & Mundie, Frost & Granger, John McMichael, Howard V. D. Shaw, Theodore Wells Pietsch, R. Bruce Watson, Wilson & Marshall, and Henry Ives Cobb. The date of delivery of all drawings at the bank was Friday, December 15, and the result was made known Tuesday, December 26. The prize, meaning the erection and supervision of the building, was awarded Architects Jenney & Mundie.

It was the privilege of the competitors to visit the exposition of the designs, and an invitation was extended to friends and others interested. It is hoped that all concerned will find in the following lines an impartial, if not entirely accurate, criticism and résumé of the exhibit.

The program sent to each architect invited reads, in brief, as follows: That the directors of the bank will form a committee to pass on all drawings, and the author of the plan approved by this committee will be appointed the architect, to complete the plans, specifications and detail drawings, for which he will receive compensation at the rate of three and one-half per cent upon the total cost of the building. The other architects will each receive the sum of $300 for their plans. The site of the building is a lot 90 by 188 feet to an alley, located on the south side of Monroe street, 50 feet east of La Salle. The building will cover the entire lot and will be fireproof throughout. The front will be three stories high and will be built of Bedford stone.

Basement will contain storage rooms, trunk rooms, safety deposit vault, etc.

First Floor.— Main entrance to building will be on Monroe street in center of lot. The space on the east side of this entrance (about fifty feet in depth) will be one office, to be entered from the main entrance, and will be provided with two brick vaults 6 by 8 feet. The space in the basement under this office is to be used in connection with it.

The space on the west side of the main entrance (about fifty feet in depth) will contain a meeting room, a directors' room, president's room and stairs to second story. These rooms are to be connected with main entrance by a private hall. The president's room will have an entrance to the banking room, which will be in the rear and will be 140 feet deep and one story high. It will be lighted from a skylight, and will have a roof that will require no supporting columns. All the electric lights in this room will be in the ceiling, as it is not desired to locate any of them at or near the desks; all windows in the rear will be not less than fifteen feet above first floor. It is estimated that at least one hundred clerks will be employed in this room.

Second and Third Floors.— These floors in front, and about thirty feet in depth, will be renting space.

General.— There will be no elevators in the building; steam heat and electric light will come from outside.

Provide toilet-rooms everywhere. The toilet-rooms for the banking-room will be back of the vaults, which will be located ten feet from the rear wall and twenty-two feet from each of the side walls.

Drawings.— The following drawings are required, and these only will be received: Plans of all stories; elevation of front; longitudinal section; perspective of front. The plans, elevations and sections are to be drawn to a uniform scale of eight feet to the inch. The elevation and section are to be drawn in line only. The perspective to be rendered in ink and the plans in black-and-white and mounted on cardboard. A detailed estimate of the cost of the building is to accompany the drawings. No plans or papers submitted are to have upon them any mark by which they can be known, but there shall be sent with them a sealed letter addressed in typewriting, to the president of the bank, giving the author's name and address. This letter will not be opened until the awards have been made. The drawings will be known by numbers corresponding with numbers given to the letters, and are to be delivered at the bank not later than December 15, 1899.

Such is the program, and although at first glance little latitude seems to have been left the architect, still the lines drawn define only the general disposition of the plan, allowing all freedom as to arrangement and details — a discussion of the fronts alone will be attempted, no other drawings being shown at the exhibit, and it seems the great stress of appreciation was fixed to the fronts.

To begin with, the prize drawing won almost unexceptional praise. Much admiration was expressed for the unique and very original treatment of four massive columns supporting an entablature and pediment, back of which is an attic motive, with angles flanked by griffins. The main entrance is cleverly treated. An arch-opening is carried through the first two stories, of strong monumental effect, and these arches are admirably in keeping with the square windows on either side of the central feature. The spaces between the columns on both sides of the doorway are partially filled by pedestals supporting bronze lions six feet in height, and these, it is said, will produce a very impressive effect. The whole mass is well composed and extremely original in conception. Unfortunately, however, the projection of the central feature necessitates setting the building back between the party walls, and about the bases of the columns it will be difficult to prevent an accumulation of débris. Still, the many other qualities outweighed these considerations and we are glad to say that the judges were willing to make some sacrifice and adopt a design which, though less economic than others, as it requires the loss of quite a number of square feet and sacrifices some light in the third story, yet will have such an architectural and monumental appearance, both in the simplicity, elegance and grace of its lines and the happy contrast of wall-space and opening, that there is every compensation, and the city may boast another unique building and architecture a landmark. We have only one other suggestion to offer, that perhaps the columns, instead of receiving an isolated base, might have rested on a common platform, as is the case with the Greek temple, but then there are a number of exceptions to this rule, among which are the city and county buildings.

The eight other drawings presented are generally handled in a masterly way. One shows a rich portico of columns doubled, with seven openings recalling the Perrault façade of the Louvre. The base is treated with elegance and dignity, and the author deserves much credit for the ingenious solution of the main entrance; for, finding the intercolumniation too narrow for the doorway, he has not hesitated to bring the central columns down upon a void, yet ably obviated this criticism with a strong white band running across the entire façade beneath the bases of the columns. The main entrance with the two flanking windows in no way seems crowded. The grouping, on the contrary, is very pleasing, and the triangular pediments over the windows in the second story give animation and play to the horizontal lines and accent the amplitude of the bays. We would have liked to see a design with this same motive of the doubled columns, and nine openings. The central doorway could have been arched to receive the columns above, and perhaps combine in a motive to include the adjacent windows. Nine openings would certainly have given a broad and generous scale. Another drawing shows a pediment over the central feature of the openings, and this pediment is happily recalled below over the main entrance. There are five openings in the façade, with columns extending through second and third stories, the whole crowned by an entablature and attic, with central pediment containing sculptured group and terminated with trophies. The base is well accentuated. Variety and interest is given by breaking the lines to carry down the central features and the two end piers of coupled columns. The windows, particularly in the first story, are robust and of very pleasing proportion.

The design with the high roof was perhaps not quite appropriate for a bank, but apart from this consideration has many good points, among which can be named the charming feature of the open loggia and porch beneath. Another drawing develops the main entrance, carrying the motive three stories and framing with Ionic columns surmounted by trophies of globes and eagles, enhancing the monumental effect. The first two stories are combined in a treatment of strong rustication. The third is enriched with a handsome frieze of shields and garlands. The window openings show great simplicity in composition and much study of proportion. The criticism might be advanced that the central doorway, carried through three stories, interferes with the office room in second and third, but the gain in monumental character to the main entrance seems sufficient compensation for this sacrifice.

The architect of the design showing the center spaciously lighted and divided into three great openings by two columns, solved with success a problem of many difficulties. The first story treated in rustication is well pierced by larger windows where light is most needed and this without detriment to a solidity of appearance. On the contrary the angles of the building and scale of masonry joints and voussoirs are extremely well studied.

The roof termination was quite successfully carried out by one of the competitors. The design shows a columniated treatment through first and second stories and main entrance carried to third story. Interest is given to the cornice by a large clock motive of most pleasing composition. Otherwise the segmental arch-windows through the second story lend a great scale and monumental character to the effect, and if the above criticism as to the sacrifice of offices in second story due to height of entrance is suggested it can be met with the same argument we have just mentioned.

The design showing seven openings and single Corinthian columns is well thought out, and much study seems to have been given to proportion. The base shows simplicity and strength, and the main entrance is pleasingly tied in by the principal lines. We would have preferred to see the columns coupled instead of single and the main entrance crowned by a pediment instead of balcony, but this is a matter of personal taste and a question of selection.

We do not hesitate to say that we think the design showing five openings, with coupled-columns resting on vigorous first-story base, to be one of the best. The bank character is well pronounced, and the general treatment has much dignity and charm. Light may have been somewhat sacrificed, particularly in first and third stories, but these are secondary considerations that might easily be remedied by increasing the width and height of openings, and so also the columns of the façade, which would gain and dominate to better effect the height of first story.

The above lines are from notes taken at random and without an idea of classification, which any critic may make for his own satisfaction. And we can add that not only the directors of the bank but all who saw the exposition were most pleased with the effort made by the competing architects, and the excellent results attained during the relatively short period of three weeks, the time given to prepare the drawings.

The architects, Jenney & Mundie, won the prize in a certainly difficult contest, and to the professional man that must be a keener satisfaction than the acquisition of a job without competition. It is only to be regretted that more such opportunities do not occur in the architectural world.

Consul Atwell, of Roubaix, reports that an artificial stone from Belgium has recently been introduced into the French market, which is said to have four times the force of resistance of French free stone, and which has nearly all of the properties of Cobestang granite. It has been tried in the Malines arsenal and is found to be insensible to the action of cold, absorbs only six to seven per cent of water, even after a long dry spell, and can not be crushed under a pressure of forty kilograms (88.184 pounds) to the square centimeter.

MODERN FRENCH ARCHITECTURE.

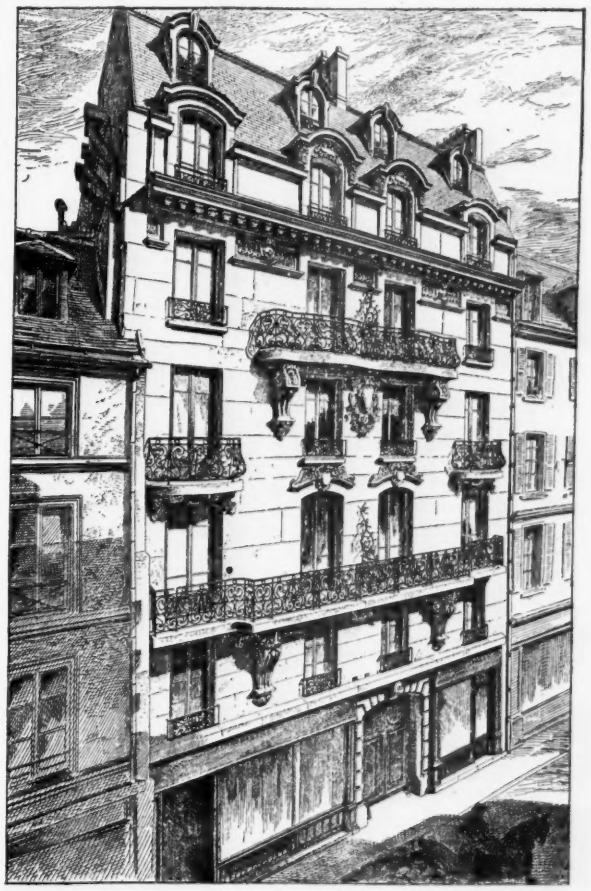
BY THEODORE WELLS PIETSCH.

ONE of the new architectural publications recently put on the market is entitled "Modern French Architecture," and both in matter of interest and excellence of workmanship it has taken a place in the front rank. It is a simple portfolio of photogravure plates, one hundred in number, dealing for the greater part with the dwellings and apartment houses of Paris constructed during the past few years. The work has only been a few weeks before the public, yet the profession has not been slow to appreciate its value, and the editors, Bates and Guild, have scored another success in this attractive *edition de luxe*. They have understood the gap long existing in the architect's library concerning modern French work, and have taken the first steps to fill it. "Ce n'est que le premier pas qui certe," and we would be glad to see them pursue the end and next consider monumental French work, for such an attempt would meet the hearty endorsement of the best of the profession and do much for the education of our young architects and draftsmen in the offices and schools.

This initial endeavor on the part of the well-known Boston publishers gives us a taste for more. A great deal of sound judgment and discrimination has been shown in the selection of subjects in the "Modern French Architecture," and the architect in sympathy with the playful and the picturesque will find it here allied with the structural feeling, the architectural sense so characteristic of the French. Almost unexceptionally there is a logical and fitting use of materials, without triviality or petty conceits, and combined to give new and pleasing effects. The lover of the quaint, the formal, the chaste or exuberant will not go begging

in this varied assortment of Paris houses, in which the authors have shown so much ingenuity and imagination. And among all these prints there are perhaps some that will become ready favorites — pet documents, so to speak — to which we turn willingly as to an old proverb in time of need.

Plate XXIII, for instance, might be classed with the *elect*. It shows a very clever modern adaptation of the Henri IV. style. There is a very happy contrast of wall space and openings, of whites and grays, of surfaces and decoration in a harmonious and novel way and not wanting in expression. The thin-arched loggia,



while perhaps a little at fault in scale of great window over doorway, is yet so cleverly treated as to make it quite acceptable. It is perhaps one of those cases where, as Ch. Garnier says, "It is better to be happy illogically than unhappy according to the rules of logic."

Plate XV shows an artist's house, to judge from the large window or studio light in top floor. There is a pronounced leaning toward the mediæval in the composition, not without charm, although we feel a little dryness in the general impression. While this is not in any way true of Plate XL, which affords a most pleasing study in brick in colors, wood cornice and stone base, the work is very fine in line with a very fine sense of proportion and novel in contrasts.

Quite as much can be said of the neat and spry-looking stable of Plate XLVIII, with its pointed tile roofs, half timber-work and brick.

An exquisitely studied composition is shown in Plate XXXVIII, which will not fail to please amateurs of the best period of Louis XV., although, unfortunately, the sculpture is a little small, a little trivial, somewhat wanting in interest; while in Plate XLII the decoration is well executed and generally well placed, but seems a little out of character with the theme. The roof-loggia is quaint and cleverly composed, but hardly seems a natural sequence to the stories below.

Several of the prints reproduce monumental work. Among these will be found "La Sorbonne," a detail of that bold façade on the Rue des Écoles, the Circle de la Librairie, or Publishers' Club, by Charles Garnier, admirable in composition, in color and the ingenious corner treatment; also the "Comptoir d'Escompte," of picturesque silhouette, the charming statue of Montpellier, the richly decorated façades of the Maine of the tenth arrondissement, in the exuberant lavishness of the early François I., and the Porte de Paris at Lille, a most remarkable example of splendid architecture, sculpture and statuary.

This only reviews a few of the interesting subjects produced, among which the architect and student will find a variety of valuable documents not to apply directly, as has unfortunately been

done far too often here, but to use as a source of solid inspiration. It is no proof of the beneficial inoculation of sound French architectural principles to copy their work and think to do well by servile imitation. And no people would be quicker to see the

weakness and faults of such a procedure than the very French themselves. Let us not try to out-French them, but study their excellent methods and work out our own salvation. It is not worth while trying to be more Catholic than the Pope.

ARCHITECTURAL ADVANCEMENT IN CHICAGO.

BEAUTIFUL, monumental Chicago! It is a new architectural idea which the future now promises to realize. The present can not boast of it, at least only partially. Too many of the city's larger buildings are without the merit of any ornamentation. The artistic has been sacrificed to the utilitarian — necessarily in many instances, perhaps, but wantonly in others. It is only recently that the best elements of the city's builders have awakened to a realization of the desirability of art in commercial architecture. The idea that buildings which cost millions and are expected to stand during all the coming century should be beautiful as well as useful is now taking deep root in Chicago.

The first radical departure from established custom in this behalf was made by the Illinois Trust and Savings Bank, when its building at the corner of La Salle and Jackson streets was designed and built. This structure combines all the desirable features of a modern bank building with an exterior of pleasing proportions and artistic design. On a larger scale the new post-office will be a monument to art as well as to utility. Buildings like these are a permanent addition to the architectural wealth of the city, because they are in advance of the hitherto prevailing ideas, and will not soon be superseded by newer notions. They will stand for a century in substantial beauty, restful to the eye and ennobling to the mind.

So in the new Chicago National Bank building, which is illustrated in this number, every detail has been brought into harmony with the higher architectural law of strict appropriateness, combined with classic beauty. It is evident to the most casual observer that the design is that of a bank. The impression of strength and solidity is given by the architect's treatment of the exterior. This has been most admirably done by Messrs. Jenney & Mundie, the architects, by massing of columns and projection of the entrance. At the same time a pure type of ornamentation has been preserved in the Corinthian, which delights without offending the eye. The motive of the architects was to produce a building that would suggest to the casual passer that the building was unquestionably a bank.

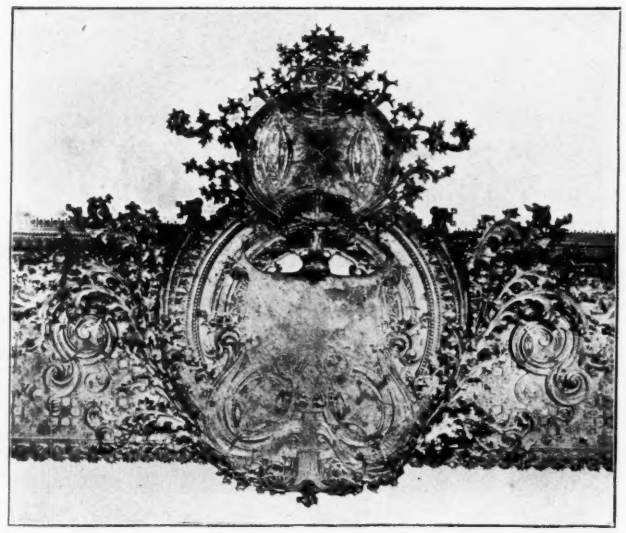
The lot is ninety feet frontage on Monroe street, fifty feet east of La Salle street, by a depth extending south 188 feet. The building covers the entire lot and will be fireproof. For sake of appearance the front of the building is three stories or about sixty-five feet high, for a depth of about fifty feet. The rest of the building is the bank room and is but a single story in height. The roof over the bank is of saw-tooth shape, taking its light entirely from the north, so as not to be inconvenienced by direct sunshine. These skylights extend entirely across the building, so as to give abundance of light. The ceiling is of ornamental glass in panels. The bank room will be 86 by 136 feet. The front is divided into five bays or tiers of openings. The three central openings are built on the lot line. The other two recede six feet so as to give a marked prominence to the entrance pavilion. The order of architecture is Corinthian, the entablature, eight feet wide, extending entirely across the front. The central portion consists of four huge Corinthian columns, fifty feet in height, four feet diameter at the base, surmounted by a pediment. The two extremes to the east and west are terminated by a Corinthian pilaster.

The interior on the first story, including the bank room, will be wainscoted the entire height of the walls in marble. The ceiling will be finished in ornamental glass in panels. The woodwork will be mahogany. The use of the two upper stories in front is not yet determined. The basement will be fitted up for safety deposit vaults, with fine broad marble entrance and stairway from the main hall. The finish of the basement will be largely in marble. The vault work will be all that is most modern and that offers the greatest security.

The work on the designs will be commenced immediately — on the building the first of May, which is as soon as possession can be obtained. The cost of the building proper, i. e., without vaults or bank fixtures, is estimated at $250,000. The material used in the construction of the building will be Bedford stone, taken from the Old Hoosier Quarry.

ARCHITECTURE IN THE SHOPPING DISTRICT.

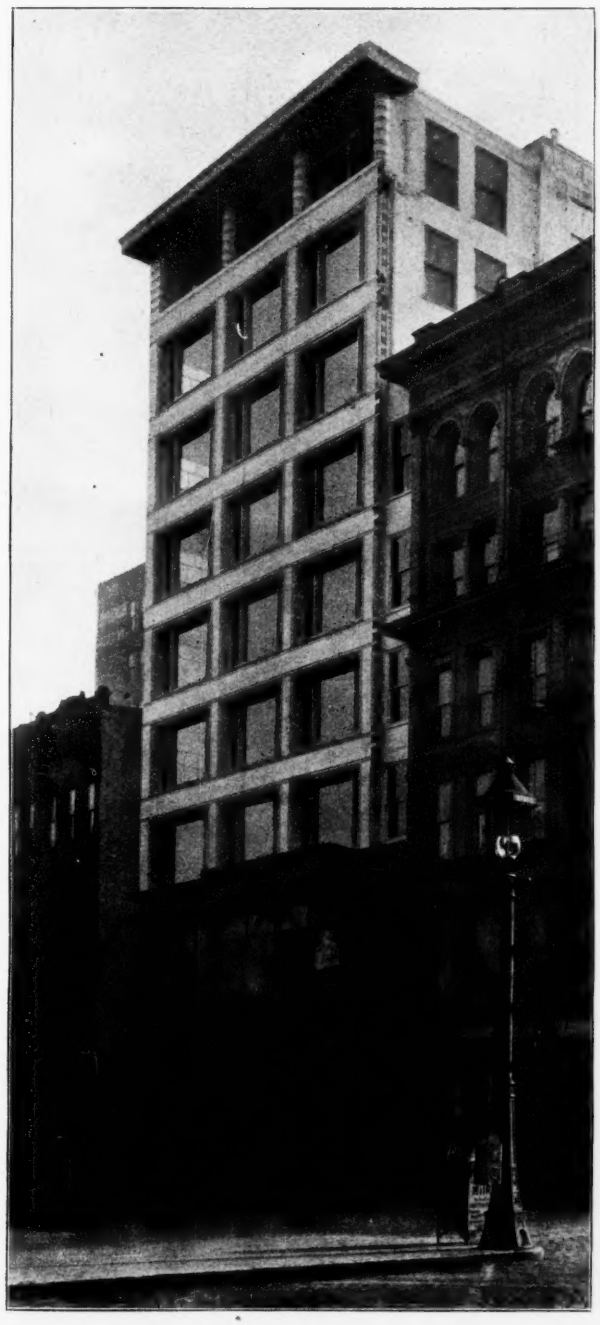
THE great shopping district of Chicago, State street, is gradually putting on an air of the artistic. Not only the show windows, wherein the newest delights of the ladies may be viewed, but in the buildings themselves, the owners having seen the necessity of time's demand for new buildings or a renovation of the exterior to such an extent as to attract the eye of the shoppers — show windows have become larger and Luxfer prisms placed in the upper portion have made possible a dustproof show case of the great windows, which are incased with panels of hardwoods, enriching the interior of the stores, the prisms throwing light from above greater than if the whole window was to be left clear of cabinet work. Ornamental iron has been used to great advantage and iron columns replace the heavy masonry pieces formerly used. The changes are seen in the great stores of Marshall Field & Co., Mandel Brothers, McClurg's and Gage Brothers, and now Schlesinger & Mayer are erecting, through the services of Louis H. Sullivan, architect, one of the most appropriate buildings for a retail dry-goods store ever seen. Only one portion of this new building is now completed, and one may conceive the effect when extended to the corner and up State street for a distance of 320 feet. The section now erected, on Madison street, is thoroughly fireproof, the iron columns and beams and fireproofing being hidden under the hardwood floors, decorated walls, and a façade, consisting of a cream-colored enameled terra-



DETAIL OF CARTOUCHE OVER CANOPY, SCHLESINGER & MAYER NEW DRY GOODS STORE.

cotta, above the third floor, an apron of Luxfer prisms in the upper sashes of the plate-glass windows and ornamental iron in imitation bronze for the base. The colonade under the cornice is striking and highly successful, giving a finish to the elevation, and the whole represents as near the expression of a retail dry-goods store yet obtained by any architect in the world.

The use of enameled terra-cotta in this building was undoubtedly decided on after careful study of different materials. It is an established fact that enameled terra-cotta can be washed down with water, and even the rain will keep it clean and bright as long as the building stands, so different from some structures that seem to gather the dirt and grime of the streets and atmosphere, making it an expensive operation to clean, and so painting is often resorted to, being less expensive than cleaning; thus terra-cotta is gradually working its way into great buildings and private residences where formerly other materials were used. The Northwestern Terra-cotta Company deserves credit for the work accomplished in this building for the uniform color of the façade, and the joints



MADISON STREET ELEVATION OF SCHLESINGER & MAYER NEW DRY GOODS STORE.

rounded to $\frac{1}{16}$ of an inch, almost a minimum. The ornamentation of the soffits and jambs of the windows give the building a character of rich simplicity; and the ornamental iron door on the façade and canopy is highly ornate and possibly extreme, but the design is carried out in such rich ornamentation, the cartouches so delicate and well balanced, the lines of demarcation so carefully worked out, that it apparently expresses the climax of the capabilities of cast-iron and becomes a study for the student. The low relief on the broad surfaces, brought into contrast with the florid embellishments, forms an extremely pleasing effect. It has, no doubt, been greatly due to the accomplished artisans, Winslow Bros. Company, and to their fine plant, that this work has reached such perfection, not forgetting that the design is purely Sullivanesque. The windows have been made broad and high, aproned with Luxfer prisms, which accomplishes the lighting of the different floors to perfection, sending in the rays of daylight and killing the glare of the plate-glass; and so Chicago as well as the owners, Schlesinger & Mayer, may be justly proud of their building and Architect Sullivan.

PROSPECTUS OF TENEMENT HOUSE EXHIBITION.

IT is proposed to hold under the auspices of the Tenement House Committee of the Charity Organization Society of New York, in the month of January, 1900, an exhibition of all phases of the tenement-house problem, such an exhibition to include a number of models representing: *a.* A block of existing tenements taken from some block in the city. *b.* A block of tenements as it would appear if each house were built on the present "dumb-bell" plan. *c.* A number of blocks of model tenements scientifically planned; each of such classes of models to have appended a statement of the percentage of land occupied, clear rentable area, cost of building and land, expenses of operation, rentals, profits, etc.

The exhibition will also include: 1. A comprehensive and exhaustive study of existing model tenements in the different cities of the United States, such study to be illustrated by a series of plans, diagrams, charts, photographs, etc. In this connection it is proposed to hold a special competition, open to all architects, for an average city block (200 by 400 feet) of model tenements made up of independent units; the object of such competition being to obtain plans of model units which, while embodying in themselves the advantages of economy of construction, convenience of plan, good light and ventilation, cheerful outlook, and as great as possible a concentration of light and air space, shall, when repeated or combined in block form, secure these advantages in a still higher degree. 2. A study of existing model tenements in foreign countries, illustrated by a series of plans, diagrams, photographs and tables of statistics. 3. A study of suburban tenements and working people's cottages, at home and abroad. 4. A study of model lodging houses and hotels for wage-earning men and women. 5. A study of public parks and playgrounds, libraries, baths, cooking schools, recreation piers, etc. 6. A study of tenement-house conditions, showing density of population, death rate, nationality of tenants, their occupations, incomes, expenditures, recreations, pleasures, overcrowding, dangers from fire, health conditions, etc., illustrated by charts, maps, statistics, photographs and reports. 7. A study of tenement-house laws and of the work of tenement-house investiating committees. 8. A bibliography of the tenement-house question.

It is proposed to hold coincident with this exhibition a series of conferences and public discussions of the questions involved. It is intended to hold the exhibition both in the residential and tenement-house districts of this city, and if practicable to repeat it in Boston, Chicago, and possibly other cities, and to send a part of it to the Paris Exposition of 1900 as part of the exhibit of this country in the Department of Social Economy. It is also expected that the exhibition will find a permanent place in New York.

The executive committee consists of Elgin R. L. Gould, I. N. Phelps Stokes, Robert W. De Forest, and Lawrence Veiller, secretary, and specifications for the competition can be obtained by addressing the secretary at 105 East Twenty-second street, New York city.

A NEW PARIS COMPETITION.

THEODORE WELLS PIETSCH sends the following report of the jury on the competition opened by the municipal council of Paris to all architects of houses built during the year 1898, from the Bulletin of the Society of Architects Diplomés:

The municipal council of Paris, in session December 7, 1897, founded a competitive prize to be awarded buildings of artistic merit in the new street Reáumur, recently opened.

The same day, on the motion of Le Breton and Thuillier, it was ordered that this competition should be extended to include not only the buildings in the new Reáumur, but those erected from year to year in the whole city of Paris. That the proprietors of the six houses awarded prizes should be exempt from the payment of street improvements and the architects receive in each case a premium of 1,000 francs.

During the debate the council defined its position to mean the façade of a building as a street embellishment, with no other considerations.

December 21, on a motion of M. Thuillier, it was further resolved, that together with the architect originator of the work, the contractor as well had a part, and should receive a medal in bronze.

The administration endeavored to give the requisite publicity to this decision, both through public proclamations and in the official municipal bulletin. All competitors were required to declare themselves by December 15, 1898, at latest. However, in spite of these precautions many architects, unacquainted with the mechanism of this new competition, or confusing this one, which interested all Paris, with that reserved only for buildings in the rue Reáumur, failed to register or made their application too late.

The jury found fifty-three "projets" at the first of its six meetings which represented, of course, only the work of those applicants who had registered within the limit of time. At the outset, and during the process of discrimination, the members of the jury were clearly instructed that the competition had façades alone in

view, independent of the natural ties that bound them to the plan and all exigencies, locality, rich or poor, wide or narrow street, more or less suitable ground, and finally without regard to money questions or a logical and rational construction.

Owing to the infinite diversity of the programs forced upon the architects by the contingencies enumerated above, the task of the jury was no easy one. The idea was to see as broadly as possible and to give the preference to a harmonious ensemble, be it of a strong or playful character, erratic or quiet, but of sufficient variety to break, by decorative features, the network of horizontal lines that render our streets too monotonous. Consideration was given the happy contrast of wall surface and openings, sobriety in sculpture motives, and last and above all the whole, the general effect of what constitutes "l'œuvre."

It was very satisfactory to note the constant falling away from the conventional and the factitious fitting of the ancient arts to our needs and our new materials. The jury did not wish to compare too closely works both the origin and purpose of which rendered so different in design, and resolved to make no classification that could be interpreted as artistic ornamentation, as an expression of a certain tendency, but esteemed its decisions in the light of an annual mention of our Parisian architects toward the improvement of the streets.

At the close of the judgment the jury expressed the hope that the value of competitions of this sort would increase from year to year, and that the architects would respond to the wishes of the city, which with a new and more liberal application of the ordinance, would bring back to our streets variety and a picturesque animation.

PAINTS IN ARCHITECTURE.

THE LOGIC OF PREPARED PAINTS.

THIS is a labor-saving age. It is also an age of specialties. Man-power, with its limitations and imperfections, is not used for accomplishing what can be done more expeditiously and more efficiently by machinery; and with each day greater value is placed upon the intelligence and less upon the muscle of man. Tints and colors that were formerly made by hand power, grinding with slab and muller the dry pigments and the oil, are now ground and incorporated in vast batches by machinery. The master painter's skill and judgment are still required, but his muscular power is at a discount.

It has been found that one steam-driven paint mill can accomplish the muscular work of a hundred men, and that the resultant product is more homogeneous in texture, more economical in production and more satisfactory in use.

As a technical fact, it is well established that combinations containing two or more of the white pigments form a better base for paints than is obtainable by the use of either of the component pigments alone. Thus zinc and lead, zinc and barytes, or zinc, lead and barytes in combination, give more satisfactory results than either of these pigments by itself. The authorities of the Pennsylvania Railroad, for example, recommend equal volumes of white lead and zinc white, with the addition of as much inert matter (barytes, gypsum, etc.) as can be introduced without interfering with the obscuring powers of the paint.

Such combinations are made and sold by paint manufacturers in enormous quantities, and are used everywhere with entire satisfaction; but when the painter attempts to duplicate the results by shop-made combinations he generally fails. The reason for such failure is not far to seek: it lies in the inadequacy of human muscle as a substitute for steam power. The power-driven mill accomplishes what is impracticable for human agency—a thorough and intimate union of the component pigments and oil.

Even the production by hand power of homogeneous tints is scarcely possible, as could be readily demonstrated by running half of a batch so produced through a paint mill and noting the improvement effected by such treatment.

The logic of prepared paints lies in the superiority of machinery to muscle. Combinations of zinc white and white lead, produced in the sweat of a journeyman's brow, may and logically should fail to give satisfaction; but such combinations, produced by machinery under competent supervision, will surpass both in appearance and in wear the unalloyed pigments.

CHARLES JOURDAIN.

NEW PUBLICATIONS.

ESTIMATING FRAME AND BRICK HOUSES. By F. T. Hudgson. New York: David Williams Company.

This is a little book, the title of which fairly describes its purpose. It appears to be well put together, and will be of service to carpenters and also to young architects who have not had much experience in actual construction. To an old and experienced architect, however, we do not think it will be of any particular value. The art of estimating is largely in knowing the cost of materials, and as the cost of materials fluctuates very considerably it is impossible to tell what a building may cost in the distant future. If a young architect of little experience would look in this book it would probably put him in the way of knowing how to proceed in making estimates; but as to prices given, though they may have been correct at the time they were written, it by no means follows that they are correct at present. Therefore such books should be used with caution, certainly so far as prices are concerned. This book, however, appears to be a good one of its kind.

THE December number of the *Southern Building News*, the first annual edition of that publication, is a credit to its publishers and to the building interests of the South which it aims to represent. From the artistic title-page in colors to the last of the most encouraging display of advertisements, it presents an artistic typography of the first order. Its subject-matter and profuse illustrations are as attractive as they are representative of the strong development of the South along the lines of better and more refined buildings. Its news department seems to be conducted by an energetic corps of correspondents. As a whole it is a welcome addition to the field of current architectural literature and its future should in no small degree influence the development of the Southern States. The *Southern Building News* is published at Memphis, Tennessee, with offices at Memphis and Chicago.

OUR ILLUSTRATIONS.

Competition for Chicago National Bank Building. Accepted design by Jenney & Mundie, architects. The following architects submitted additional designs, which are published: Theo. W. Pietsch, John McMichael, Henry Ives Cobb, Frost & Granger, Howard V. D. Shaw, Wilson & Marshall, S. S. Beman, Watson & Hazelton. For a review of the designs, see another column in this issue.

The views in our illustration pages give a fair idea of the housing of the social settlement known as "Hull House," at 335 South Halsted street, corner of Polk. Pond & Pond, architects. When the settlement was started, a little over ten years ago, in the second story of the old Hull mansion, one of the more pretentious of early Chicago homes, the time of the leasehold was short, and no permanent improvement in the line of building was thought of. The needs, however, began to develop when the settlement crowded out the manufacturing interests which had occupied the remainder of the building, and the old mansion was restored to somewhat of its former dignity and given over wholly to the purposes of the settlement. Other buildings were started, but the short period of the lease made substantial buildings and a unified scheme of development almost out of the question. The donation, however, of the land for a long term of years made it possible to add a better class of buildings to those which were hastily erected to fill the first needs. The group presents a general harmony, but the conditions under which the various parts were erected has made impossible that complete unity in the ensemble for which an architect strives. A little picturesqueness of grouping, however, may have been gained. The Hull mansion proper was remodeled and enlarged by the addition of a third story, which was used for women in residence; the Butler Gallery, containing an art exhibition room and lecture room in one building, was erected, and this afterward received the addition of a third story for men residents; the children's building on the corner followed, and was more substantial in the matter of construction, and thoroughly studied in the matter of plan; a building containing gymnasium, kitchen, coffee room and clubrooms followed at the rear on Polk street, and lastly the auditorium and new coffee house, a substantial and thoroughly fireproof building, has been erected in the space between the gymnasium and the children's building, making the group complete. In the lecture room are held the meetings of various clubs, including the "Arts and Crafts" Society. In the auditorium are given plays and concerts by various clubs connected with "Hull House," and the floor is made level to permit of dancing and social entertainments, which are frequently held therein. The materials used in construction are generally of the simplest of the various kinds, such as common brick, paving brick treated with due respect for color effects, and very simple in masses. In the various clubrooms the wood of the timbered ceilings is stained in deep, rich tones, and the effect throughout is of a quiet, domestic character. The coffee room is the only room in the group which is at all pretentious in its design, and that is made quiet by the very simplicity of its massing and material, and the softness of tone in the brick and tile which show upon its interior. The auditorium, as the plates will indicate, depends upon the color and massing of the brick and broad surfaces of plaster for its general effect.

Photogravure Plate: Detail of lower stories, store building for Schlesinger & Mayer, Chicago. Louis H. Sullivan, architect.

PHOTOGRAVURE PLATES.

Issued only with the Photogravure Edition.

Residence for Floyd J. Smith, Chicago. R. A. Denell, architect.

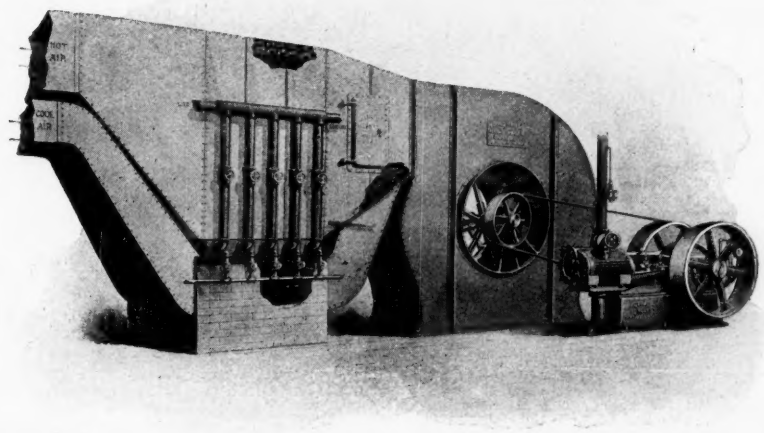
Spalding Institute, Peoria, Illinois. Reeves & Baillee, architects.

Warehouse for E. C. DeWitt & Co., Chicago. Samuel K. Colton, architect.

First Church of Christ, Scientist, Peoria, Illinois. Reeves & Baillie, architects.

The "Hull House" Group, Chicago. Pond & Pond, architects. These are shown: An exterior view, the reception hall, the coffee room.

Buffalo Fan System of Heating, Ventilating, Drying and Cooling.



Apparatus arranged for a Double Duct System.

Electric Light Engines, Forges, Blowers, Exhausters.

Buffalo Forge Co.

BUFFALO, N. Y., U. S. A.

New York. Chicago. Cleveland. Philadelphia.

DIXON'S SILICA GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

Chicago Floor Company

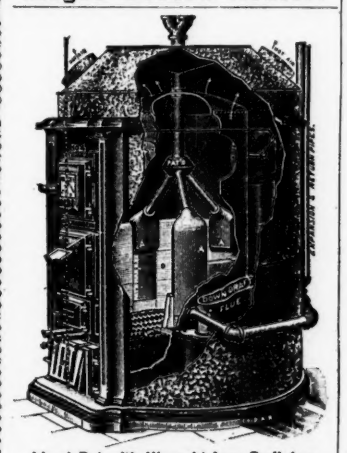
Manufacturers, Jobbers and Layers of

Ornamental Hardwood Floors, Parquetry, Wood Carpet, Grilles.

155 WABASH AVENUE (near Madison St. Station),

Telephone, Central 1043. Send for catalogue, free. CHICAGO.

Magee Boston Heater.



Lined Pot with Wrought-Iron Radiator.

FOR HEATING WITH WARM AIR, OR IN COMBINATION.

WARM AIR AND HOT WATER.

ASK THOSE WHO USE THEM

If the **MAGEE HEATERS** are not

The MOST DURABLE, as well as the MOST ECONOMICAL and EASILY MANAGED.

They give a mild, steady heat and the effect upon the humidity of the atmosphere is so slight as to be imperceptible—adding greatly to the healthfulness of the dwelling.

MAGEE RANGES

Meet all the requirements for the most exacting work in the kitchen.

USED AND RECOMMENDED BY LEADING AMERICAN AUTHORITIES ON COOKING.

WE MAKE ALL STYLES BUT ONLY ONE GRADE ✲ THE BEST.

Send for Pamphlet. Correspondence Solicited.

J. D. LOTT & CO.

Telephone, Main 2863. GENERAL WESTERN SALES AGENTS,

86 LAKE STREET, CHICAGO, ILL.

Without Using Any Chemicals

SCAIFE FILTERS

WILL FURNISH

CLEAR, PURE WATER.

CAPACITY: 10 TO 10,000 GALLONS PER HOUR.

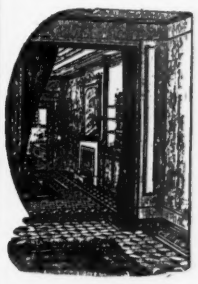
Simple in Construction

Easy to Operate

Results Guaranteed

☞ CATALOGUE ON APPLICATION.

Wm. B. Scaife & Sons, Pittsburg, Pa.



Hardwood Floors

Wood Carpets, Parquet Floors, Rug Borders.

Send for book of designs.

E. B. MOORE & CO.

48 & 50 Randolph Street, CHICAGO, ILL.

Martin G. GOOD

Photographic Supplies for Architects and Draftsmen.

92 State Street, CHICAGO.

ILLINOIS CENTRAL

Runs Two Solid Vestibuled Trains Daily

DIAMOND SPECIAL NIGHT TRAIN

DAYLIGHT SPECIAL DAY TRAIN

between Chicago and St. Louis.

Free Reclining Chair Cars, Parlor-Café Cars, Pullman Buffet Open and Compartment Sleeping Cars. See that your ticket between Chicago and St. Louis **Reads via Illinois Central Railroad.**

It can be obtained of your local ticket agent.

A. H. HANSON, G. P. A., Ill. Cent. R. R., Chicago, Ill.

THE INLAND ARCHITECT AND NEWS RECORD

Vol. XXXIV. ADVERTISERS' TRADE SUPPLEMENT. No. 6

Valuable Publications Free.

Any architect can secure valuable books of reference without cost by sending for the catalogues of materials, etc., noticed from month to month in these columns. Large sums are spent on these catalogues, and they contain much practical information. Many are art productions. They may be obtained free on application to those issuing them. In writing please mention THE INLAND ARCHITECT, and oblige the journal and the dealer.

REQUESTS FOR CATALOGUES AND SAMPLES.

Those wishing catalogues and samples sent them by dealers in general may have their names inserted under this heading free of charge. The only recompense desired is that the dealers who send catalogues to these addresses give THE INLAND ARCHITECT due credit for business benefits that result.

ARTHUR J. WILLIAMS, Architect, Oklahoma City, Oklahoma.

MORRISON H. VAIL, Architect, Unity building, Chicago, has opened a branch office at Dixon, Ill., and desires catalogues and samples.

MR. JOHN STAFFORD WHITE, who has been in charge of the draughting room of the St. Louis office of Messrs. Shepley, Rutan & Coolidge, for the past three years, announces that he has opened an office in the Chemical building for the practice of architecture, the rendering of architectural drawings in water color and pen and ink, and the making of special designs for furniture, gas fixtures, etc. He will be pleased to receive samples, etc., from the trade.

ARCHITECT, Box 307, Vicksburg, Mississippi, will be glad to receive catalogues of all classes of building materials.

The general offices of the J. RIELY GORDON COMPANY, Architects, have been moved from San Antonio, Texas, to their new building, corner Main and Field streets, Dallas, Texas, where they will be pleased to receive catalogues and samples.

A 445,000,000-GALLON RESERVOIR.

One of the largest reservoirs ever constructed is to be built by the Chicago, Burlington & Quincy Railroad for the purpose of supplying its engines and shops with water. It will be located five miles southeast of Galesburg, a division point on the main line, 163 miles from Chicago. The reservoir will be two and a half miles long, 1,500 feet wide, and 20 feet deep, and will have a capacity of 445,000,000 gallons.

CAPITALS.

Capitals, the crowning members of supports, in their various forms have been used since the beginning of the art of building, and as civilization has advanced the art, the ornamental parts of structures have kept pace with the purely mechanical and practical improvements. Thus, we have now beautifully designed, carved and modeled capitals, where once a mere rough block was used for a support finish. Truly, the excellent specimens of capitals executed in marble by the Greeks and Romans in their temples still serve the present generation as models, but where with those ancient races it was the privilege of only a few to possess such fine details on their buildings, those being even mostly confined to public edifices on account of their high cost of production, we now are enabled to all enjoy the beauty of fine capitals on very moderately expensive buildings and houses.

From the bolder designs for exterior uses on façades and porches, executed in cement composition and very durable, to the daintily detailed capitals for interiors in plaster for wall decorations, or in connection with woodwork, in composition carving, the modern capital has taken its place to stay. While beauty and variety of form have increased to a point of rare refined taste in the manufacture of capitals, price has been lessened with the increased demand for them, so that now there is no building complete without some of the fine capitals attached thereto.

The new capital catalogue of the Decorators' Supply Company contains the finest selection of capitals of all different styles and periods, and shows the different applications to which capitals can be put. Any one interested in building should write for this catalogue to the Decorators' Supply Company, 215 South Clinton street, who are the foremost manufacturers of capitals.

THE "OLD STYLE'S" BURDEN.

(*With apologies to Rudyard Kipling.*)

Take up the "Old Style's" burden—
Send forth the stuff ye breed—
Go, bind those brands to exile,
That serve dishonor's greed;
To waste, unsold, forgotten,
Through competition wild—
Your full-fledged imitations,
With truth irreconciled.

Take up the "Old Style's" burden—
In patience to abide,
To shield the trade from error
And thrust deceit aside;
By honest ways and open,
To expose the brands, that fain
Would seek another's profit
And steal another's gain.

Take up the "Old Style's" burden—
Each claimant's fresh caprice—
Bewilders buyer—architect—
And bids the contest cease;
For when your sale is nearest
(The end by others sought)
"The Equals!"—worse than folly—
Bring all your hope to naught.

Take up the "Old Style's" burden—
With all the cares it brings;
With rack of brain and trouble—
The fate of worthy things.
The cost ye shall not enter,
The roofs ye shall not tread,
Go, tin them for your living,
To last when you are dead.

Take up the "Old Style's" burden
And reap its just reward—
The thanks of those ye better,
The hate of sham and fraud—
The cry of those converted
(Ah, slowly!) toward the light;
Who know the Taylor's trade-mark—
Its guarantee of right.

Take up the "Old Style's" burden—
Ye dare not use a less—
Nor call too loud on others
To cloak your thoughtlessness.
By all ye wish or covet,
By all ye say or do,
The silent sullen weather
Shall judge your roof and you.

Take up the "Old Style's" burden!
Have done with childish ways—
The long-neglected laurel,
The deep-begrudged praise—
Comes now to greet your efforts,
Through all the thankless years,
And crowns with dear-bought wisdom
The judgment of your peers.

TRADE NOTES.

THE Powers Regulator Company will install their system of heat regulation in the new High School building at Joliet, Illinois. The company is making an application of their apparatus to the control of temperature in railway cars, and report very successful work in that line. They will be glad to send a catalogue to parties interested.

THE new Empire building, Pittsburg, Pennsylvania, will contain two Scaife water filters having a combined capacity of 3,500 gallons per hour. The arrangement contains a unique feature, being designed so that either filter can be shut off from the main supply pipe while being cleansed, the other filter meanwhile furnishing the filtered water for the entire building. William B. Scaife & Sons, of the same city, are the manufacturers of these filters, which contain no chemicals or coagulants of any description.

C. A. PAQUETTE, Engineer Maintenance of Way of the Peoria & Eastern Illinois Railway Company, writes the Buffalo Forge Company as follows:

Your letter of the 10th inst. in reference to our heating plant at Urbana, Illinois. It affords me pleasure to say that the heating plant which you put in at that point is most satisfactory. In the latter part of February we had three days in which the thermometer registered 26 and 27 degrees below zero, and the shop buildings were all very comfortable during that period; this, too, with the shop buildings in a very exposed place. On the warm days this summer we have used the plant for cooling purposes and the result was highly satisfactory. I am very pleased with the way it has worked.

THE Jenkins Brothers, in their 1899 catalogue, present the merits of their wares in a convincing and attractive form. They make a specialty of valves, disks and packing, and show their patterns, sizes and prices in a tabulated form easily referred to and certain to be appreciated by those interested. They make a strong claim in the following terms: "If you will put a Jenkins Brothers valve on the worst place you can find, where you can not keep other valves tight, and if it is not perfectly tight, or does not hold steam, oils, acids, water or other fluids longer than any other valve, you may return it and your money will be refunded." Chicago office, 31-33 North Canal street. Offices also in New York, Boston and Philadelphia.

ATTENTION is called to a new departure of importance to readers and advertising patrons. It is an automatic library and parcel service, patented November 7, 1899, and as noticed in the *Scientific American* of November 25, 1899, requires no remodeling of buildings, yet offers suggestions to architects. It adapts itself to old-time structures, but differs from the basket-carrying devices at present in use in the most up-to-date libraries which are planned in deference to these primitive and expensive aids. The newer idea meets the demands of modern concentrating colossal library collections, and facilitates the rapid and economical handling of books in a manner hitherto thought impossible. It favors or prefers a high central hall or tower connecting with the different rooms or departments, either on one or several floors, as against the opinion of experts, who, of course, reckoned without this mechanism as a known factor in an ideal library plant. The mission of the Library and Parcel Servitor is automatically to convey books back and forth between their shelves and a central "desk," either upon the same floor or other floors, and simultaneously to register the taking out and return of every book. All this work is performed within a minute by means of conveyors and electrical circuits connected with a central switchboard. The invention is also adapted for use in insurance and railroad offices, music-publishing houses and department stores, where file-boxes or similar parcels are handled. The system dispenses with stepladders and superfluous help connected therewith. The shelves and desks can be compactly arranged so as to save space and reduce expenses. Full particulars may be had of J. Colditz, 78 William street, New York.

Expanded Metal Concrete MONOLITHIC CONSTRUCTION.

THE BEST SYSTEM OF FIREPROOFING

in general practice today. Applicable to any character of building.

Expanded Metal Lathing is the standard in all markets, and is specified by all leading architects. For detailed information address:

Northwestern Expanded Metal Co.,	Chicago
Central Expanded Metal Co.,	Pittsburgh
Eastern Expanded Metal Co.,	Boston
Expanded Metal Fireproofing Co. of Pgh.,	Pittsburgh
New York Expanded Metal Co.,	New York
Southern Expanded Metal Co.,	Washington
Expanded Metal Fireproofing Co.,	Chicago
Merritt & Company,	Philadelphia
Buffalo Expanded Metal Co.,	Buffalo
Western Exp'd Metal & Fireproofing Co.,	San Francisco
St. Louis Expanded Metal Fireproofing Co.,	St. Louis
The Expanded Metal and Fireproofing Co., Ltd.,	Toronto

THE INLAND ARCHITECT
SUPPLEMENT

TECHNICAL REVIEW OF THE INTERESTING DEVELOPEMENT OF THE BUILDING ARTS.

VOL. XXXIV. CHICAGO, JANUARY, 1900. NO. 6.

AT the close of this most progressive century in the world's history it is fitting that we take a look behind and cast a glance ahead, and while recalling some of the most striking improvements of the past, endeavor to foretell the course of future progress along architectural lines. The science of building seems to have reached the acme at the present time, yet who can tell what the twentieth century may bring forth? There are depths unsounded and heights unscaled.

The variations of a century in building may be well seen and contrasted in New York city, which still contains many of the old-style buildings, so that it is a rare museum for the student of commercial architecture. On the other hand, her giant buildings of recent years exhibit in a high degree the application of modern ideas of architecture to business purposes.

It is a mistake to suppose that this progress is the result of anything more creditable than business necessity and individual shrewdness. The tendency of the times to centralization is responsible for nearly all we have of architectural improvement in modern cities. This tendency has brought about greatly enhanced values of real estate and consequent economy of space as exemplified in the high building. It is responsible for the system of rapid-running elevators, modern heating appliances and electric light, but primarily for the perfection of fireproofing. The world has learned that, in the matter of fire, prevention is better than cure, and that the best fireproof construction is none too good. Protection to human life demands that the sky-scraper must be absolutely safe in this regard, and so necessity has become the mother of that most remarkable modern invention in the architectural world—absolute fireproofing.

In the following pages the subject of modern building construction will be found discussed by eminent specialists in the various departments of design and execution. The publishers have thought it appropriate at this time to reap the field of experience by grouping into one volume the best thoughts of leading writers on the various topics hereinafter treated, with the view to present to the architects of this country and the world the consensus of opinion, as it were, on these most important subjects. The question, What are the essentials of a first-class modern building? will find its answer here in unequivocal terms, because answered by experts, each an authority on the particular branch of the art which he represents. It is this acknowledged high standing of the authorities here represented that makes this little treatise of the utmost value to all students of the latest achievements in architecture.

On the subject of the "sky-scraper" we are favored with a very complete and lucid article from the pen of Mr. W. L. B. Jenney. Having originated this style of construction some years ago, when it was an untried experiment, Mr. Jenney not only writes from a peculiarly original standpoint, but also recounts some very interesting experiences. He sets forth an episode in an architect's life that can not fail to be of great interest to every other architect, for he tells of difficulties encountered and overcome, and of pioneer work along an original line—work that has proved to be eminently successful, inasmuch as it has fairly revolutionized the construction of a most important class of commercial buildings. Not only is Mr. Jenney's article authoritative, but it is exhaustive, and will be a permanent contribution to the literature of fireproof construction.

The principal subjects in the discussion of modern methods—steel frame, fireproofing, elevators, electricity, heating, decoration, etc.—have been treated in this supplement at some length, and with great care as to exactness, by the several writers. While the science of fireproofing antedated that of steel construction, yet it came in with the era of high buildings as a necessary accompaniment of their safety. Without it there could be no high buildings, for obvious reasons, which are treated more fully in later pages. The same may be said of the rapid elevator service, and to a large extent of the electric lighting. All of the important accompaniments of construction which are now considered so indispensable to the up-to-date building were introduced, because there was a demand for them in the growth of the building idea. They came as a logical result of the evolution in architecture which could not brook antiquated or doubtful methods. The business world has learned that the best was the cheapest in fact as well as in theory, and a very influential part of that world insisted on having the fact.

Still other changes have come and are coming. The matter of fireproofing is bringing about a general substitution of materials—iron for wood and glass for iron—as exemplified in the making of iron window frames and the use of glass prisms and wire glass in the place of iron shutters. Decoration also was revolutionized. Exteriors must depend upon forms of terra-cotta and brick and metal for adornment, and interiors now employ grilles and marble and tiles where formerly wood was used. All this means an entire overturning of the manufacturing ideas of the past and the substitution of new designs, marked out in new factories for the future; and it is the object of this supplement to set forth in as intelligible and authoritative a manner as possible the details of all these several changes.

What the future holds in store for the building world can be best surmised from its probable necessities. Economy of light and space will be accentuated. The tendency to combinations of commercial interests will call for buildings covering a greater ground area, rather than for structures of increased height. The growth of the commercial world in wealth and in the appreciation of art will foster the ornamental in every surface detail of construction, which will create a demand for new materials and for new adaptation of old materials in endless profusion. It were a mistake to suppose that we are far beyond the threshold of the art as yet. The patient student and aspiring inventor, who looks to the needs of the coming century, as evidenced by the progress of the times along all lines, will achieve new triumphs in architecture.

THE STEEL SKELETON, OR THE MODERN SKY-SCRAPERS.—THE ENGINEERING PROBLEMS.

BY W. L. B. JENNEY, ARCHITECT, CHICAGO.

To the Editor:

In reply to your request for an article on the best modern practice in the leading lines of steel building construction, I respectfully beg leave to submit the following.

W. L. B. JENNEY, Architect.

IN 1883 and 1884, when the problem of building a tall, well-lighted, fireproof office building, with all modern conveniences, and a reasonable amount of elegance, was first presented to the writer by the Home Insurance Company of New York, for their building, then about to be erected on the northeast corner of Adams and La Salle streets, Chicago, to be known as the Home Insurance building, it was an entirely new one, one may truly say, in every particular; and for the new building everything must be invented, particularly the system of construction.

The soil on which the footings must rest was a soft, wet, compressible clay of great depth — probably about sixty feet — that could not safely carry over 4,000 pounds per square foot of surface. With the ordinary construction there was not room beneath the building for the foundations.

The many windows for the lighting of the offices so reduced the piers between openings that they were insufficient in the lower stories to carry the load of walls and floors above.

The building was to be so tall that the question of wind pressure must be considered.

Elevators passed at once from a luxury to an absolute necessity. They must be so constructed as to be unquestionably safe and at the same time rapid-running. The heavy wooden car must be replaced by a light iron one of elegant design and finish.

The fireproofing must be of the highest efficiency, for the upper stories would be entirely beyond the reach of the fire department.

As the owners were catering to the highest order of tenants — eminent lawyers and large corporations that could well afford to pay large rent, which they were willing to do provided they obtained better quarters than could be obtained elsewhere — in order to attract such tenants it was necessary to provide the business necessities, such as plenty of electric light, then just coming into general use, safety vaults, coat closets and neat wash-basins. There must be a freight elevator conveniently placed for the use of large corporations, for the taking in and sending out of stationery, etc.

All this required something heretofore unknown, but the old saying that "necessity is the mother of invention" is as true today as ever it was, and in the new Home Insurance building all these new requirements were in a measure provided by the writer, who had been selected by the Home Insurance Company as its architect. The new skeleton construction made the tall building possible. Chicago adopted it at once, and soon Messrs. Holabird and Roche, both of whom had formerly assisted the writer in his office, designed and erected the Tacoma building, northeast corner of Madison and La Salle streets, Chicago. This building occupied a lot of very restricted dimensions, which induced the architects to enlarge the offices by covering the street fronts with towers of bay windows, projecting out over the sidewalk. Little by little the new Chicago Construction, as it was then called, spread eastward, wherever the value of the land made tall buildings desirable, and soon New York city, in the use of the Chicago Construction, in height and number of buildings passed far beyond anything to be found in Chicago.

Since the introduction of the skeleton construction the writer, and many other architects and engineers, have steadily worked to perfect, to improve and to economize, so that the construction today differs from that of 1885 in many respects, particularly in the details.

I propose to pass in review the present methods that may be characterized as the best modern practice.

FOUNDATIONS.

These vary greatly according to the material on which the footings rest. The simplest problem is when solid rock underlies the building. In this case it is only necessary to dress off the rock at the proper level to receive the stool of the column.

In the business district of Chicago the underlying stratum on which all the buildings rest is a very thick stratum of soft, wet, compressible clay. Experience, that best of all teachers, has demonstrated that it is not well to exceed a load of 3,500 pounds per square foot on this clay. This load will cause a settlement of about 2 or 2½ inches that will obtain mostly during the construction of the building, and if the loads are carefully calculated so that the load is uniform on the clay at all the footings, the settlement is practically uniform, and if the sidewalk line is set up two inches at the outset of building, no inconvenience will result. Within a year after the completion of the building, the sidewalk floor will be practically at the level intended.

Caution.— The contractor should not be allowed to overload any portion of the building during construction, by concentrating a large quantity of heavy material on a small area, as is too often done.

In office buildings, hotels, and apartment houses, where the live load is very light, no account is taken of the live load in calculating the footings, but if the building is to be used as a warehouse, every endeavor must be made to learn as near as practicable the actual load that will obtain when the building is in use. This is often very difficult, especially if the building is for rent, as it is quite impossible to know in advance what a tenant, not yet procured, may put into the building; still, some assumption must be made, and a live load decided upon, and the owners instructed to make it a part of the lease that the load used in the calculations shall not be exceeded. The neglect of this has caused, in several instances that have come to the writer's notice, very serious results. In one instance, the second story was so overloaded with stoves and stove castings that the floor gave way, and the whole second floor and its load were found one Monday morning in the basement. No one was in the building at the time of the disaster. In another instance one part of the building was so overloaded that the columns under the load were forced down over two feet.

If the building is to be used for running machinery or printing presses, the actual loads must be largely increased; usually it is not safe to use less than the double for the calculations, for a moving load produces a jar that is equivalent to pounding, which will produce a lasting effect. In one instance the writer watched, when a large steam engine was running near a column, the column continued to settle for two or three years, when the engine was removed.

A Chicago office building, located so much to one side of the proper business district that it was not sought by tenants for offices, was leased in part to a large printing establishment. After the presses had been running for a couple of years, it was found that the injury to the building was becoming so serious that the owner bought off the tenant, giving him some $4,000 bonus, it was stated, to give up his lease and leave the building.

In New York city one floor of printing-presses fell into the basement of a building. An investigation was made; the investigators recommended that thereafter all large printing-presses should rest directly and independently on the ground, and not in any way connected with the building.

Between the solid rock and the soft clay of Chicago are all the known varieties of underlying strata. A careful examination by borings under each footing should be made, and the load that can safely be put on the underlying strata determined. Often it is desirable to make a test. This is easiest done by setting a post on the material at the level of the underside of the

footings. For convenience, let the post be 12 by 12 inches in cross section. On the top of the post build a floor of cross-timbers and plank, on which set a tank, which must be guyed to prevent tipping.

Take the level of top of tank and refer it to a bench-mark that will not be disturbed. Then fill the tank with water and calculate the load on the square foot under the bottom of the post. The tank should be large enough to give a maximum

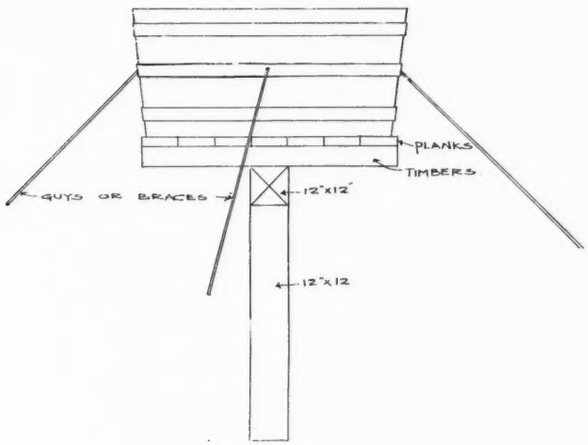


FIG. 1.

load, not less than 4,000 pounds is preferable, if the stratum is soft clay. If of hard material the test is usually unnecessary. Time is an element in the experiment, for if the stratum tested is like that underlying Chicago, a load of 4,000 pounds per square foot will show but small results the first week; still, if the operator is experienced, some valuable information can be obtained. It is especially valuable when there is liable to be soft places, such as pockets of quicksand, or an old slough filled with muck. This method of testing the material on which the Chicago World's Fair buildings were placed, proved very valuable. Here the underlying stratum was very variable, and many very soft spots were detected. In addition the tests gave the relative settlements that might be expected in the harder parts, so that the dimensions of the footings, which were piles in soft spots, and timber grillage elsewhere, were proportioned in accord with the tests indicated. The results were very satisfactory.

Pile foundations are comparatively inexpensive and reliable, whenever the tops of the piles can be kept permanently immersed, while if they are alternately wet and dry they soon decay, with disastrous results. An examination must be made at the dryest season by an excavation or by boring to learn where it is safe to saw off the piles with the assurance that they will be permanently wet.

After the piles are driven, which is done after the excavation is made that the pile may be used the entire length and not be wasted in any considerable part, the tips are sawed off, and a pier of good Portland cement concrete put in place, as illustrated by Fig. 2, on top of which set the column stool at proper level. In the new Field building, northwest corner Adams and Clark streets, Chicago, the piles were cut off about thirty-four feet below the sidewalk. The piles used are driven fifty-five feet and only a foot or two is wasted by the cutting off to receive the concrete. In this case the foundations were so large that it was necessary to introduce a steel beam grillage between the bed of concrete covering the tops of the posts and the column stools.

STEEL AND CONCRETE CYLINDERS.

It often occurs that some footings are so near to other buildings that the driving of piles would be injurious to the neighbor. In such cases a pier of steel and concrete is used. Steel cylinders are provided the full width of the steel sheet in height, riveted together at the laps. These are placed with center of the circle over center of footing and excavation begun. The steel cylinder is pushed down as the excavation progresses. When one cylinder is mostly below the surface another is added and joined to the one below as shown in Fig. 3.

At the Field bank building the concrete cylinders go down to the hard clay, which is also the depth to which the piles are driven. In this case, only the top steel cylinder was used and then sheet piling as shown in Fig. 4. These cylinders are filled with concrete dumped in from the top. The upper courses are rammed solid. The top of the pier receives the column stool.

GRILLAGE.

When the underlying stratum is not too soft, and when so situated as not to have connection with permanent water, that would make pile foundations desirable, the usual foundation is steel grillage, which, as the writer believes, was first used by D. H. Burnham in the Rookery building, Chicago. (See Fig. 5.) The beams are laid on a bed of concrete, the usual proportions being: one best Portland cement, three clean sharp gravel, three to five aggregate of broken stone, egg size.

The excavation must extend to the best underlying material available. The concrete should not be less than twelve inches thick. Too great offsets beyond the beams should be avoided; plank boxes are placed and the concrete rammed into place, finishing the entire mass before any part has set. To this end everything should be ready and enough men put on to accomplish the object.

With regard to the calculation of the beams, two methods are in use. One assumes that the beam is immovably fixed from outer edge of flange of cross-beams *b* to *a* (Fig. 5), using *a b* as the lever arm, *c* being center of the system of cross-beams. It is probable that the exact fact lies somewhere

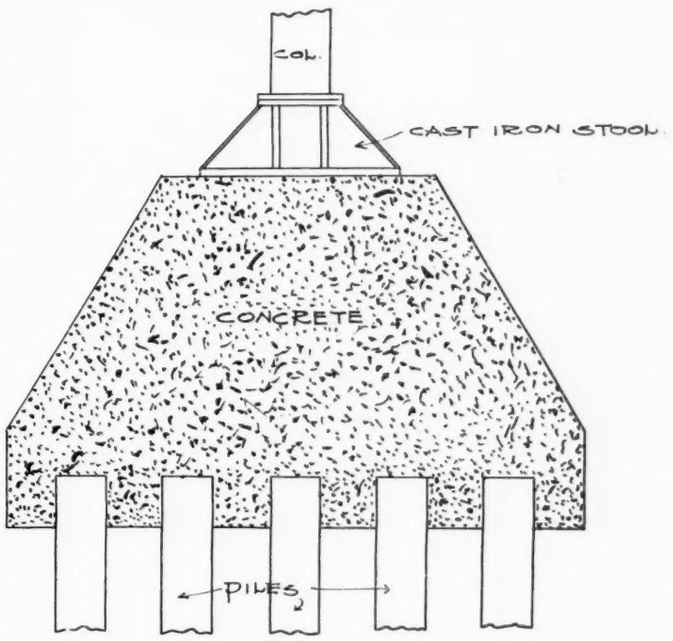


FIG. 2.

between. In his own practice the writer uses *a c* for the lever arm, as certainly the safer, and the addition in amount of steel is not great enough to be objectionable, particularly in foundations.

Owing to the liability to rust, although every care is taken to prevent it by the use of paint and concrete protection, very

light web beams should not be used. Better use the heavy sections, for an excess of steel is rather desirable in the foundations.

There should be three lines of separators and rods in each system of beams, one in center and one at each end.

The footings should be entirely imbedded in excellent concrete which should be well rammed in between beams. For

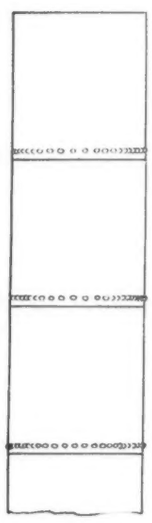


FIG. 3.

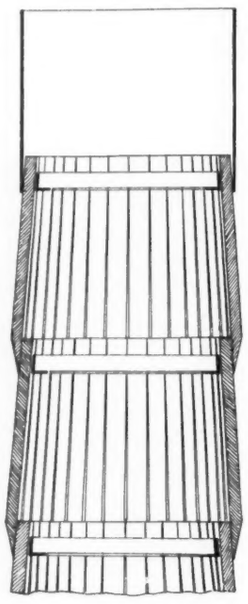


FIG. 4.

between beams the writer recommends one part best Portland cement and three parts clean sharp torpedo sand, that the concrete may replace as far as practicable any loss by decay of beams, should such occur.

COLUMNS.

The spacing of the columns is of first importance. They should be placed where least objectionable. The bank room is much benefited by reducing the number of columns standing free in the room to the minimum. It is well known that an increase of span of beams increases cost of the steel; still, it should be calculated, and if, in the opinion of those best capable of judging correctly, the increase in rental will pay a reasonable interest on the increased cost, then this increase in cost should be accepted as desirable, for the less number of columns standing free in the room will make it easier to rent the room, and avoid the complaint that is sure to obtain if there are many columns, seemingly in the way. It is true the objection to columns is usually much exaggerated; still, we must accept the situation as we find it. It is a good rule to reduce the number and size of the columns standing free in the large rooms to the minimum.

Among the numerous column sections that might be used, in order to decide which to choose, calculations and diagrams should be made of each of these, and the section that, under the circumstances, all things considered, is best adapted to the situation, from a constructive and from an economical point of view, should be adopted.

WIND BRACING.

If the building is exposed to the wind, then the columns had best be above basement, each two stories high, jointing the columns one-half in each story. Then one-half in basement will be one story high and those on top story should go through the roof space. All others are two stories in height. The favorite junction for columns is now the splice joints. See Fig 6. Thirty pounds per square foot of exposed surfaces is usually used in calculating the wind pressure.

The wind pressure on the exposed parts of the building, as per recent experiments in England, is less per square foot on large surfaces than on small. It was found by actual test that the pressure on one square foot was more than $\frac{1}{100}$ of the pressure on 100 square feet. It is argued that on a single foot square the air is quickly blown off, while on a large area the air is held against the surface, forming an elastic cushion that to some extent resists and diminishes the wind pressure. The interior columns, together with the rigid floor construction, will take care of about one-fourth to one-third of the total wind pressure, depending on depth of beams, system of construction and the general floor construction. The balance must be cared for by the exterior columns and by wind bracing in permanent unchangeable partitions of the interior. The columns in the direction of the wind in exposed walls may be enlarged, and the junctions of columns with the exterior beams of floors may be connected by gusset plates (see Fig. 7), and such exterior beams made sufficiently large to resist the stresses occasioned by the wind.

PENTHOUSES

Are usually necessary on the roof for inclosing water tanks, elevator overhead work, photograph gallery, etc. These should be built with a steel frame and brick. The ordinary hollow-tile partition with the exterior or exposed surface glazed is also good, if tile are sufficiently thick to lay up into a substantial wall, but the ordinary 3 or 4 inch partition tile does not make a substantial exterior wall.

SIDEWALKS.

The sidewalks are made either of dressed stone or vault covers of concrete, either with brick or concrete arches between beams. In either case there are sidewalk beams supporting the sidewalk extending from the exterior outside columns or the beams between exterior columns, across the vault to the curb wall. These vault beams brace the building to the curb, which is in turn sustained by the street, making a very rigid construction.

Some years ago, when the Chicago City Council ordered a revised building ordinance, it unfortunately was entrusted to

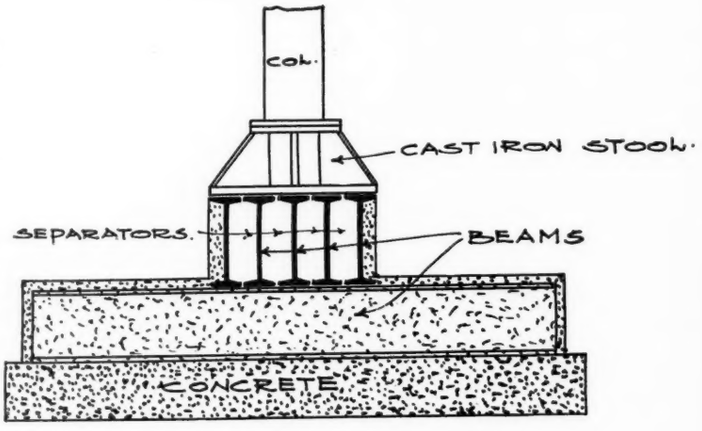


FIG. 5.

those who did not fully appreciate the skeleton construction (which was discriminated against by the new ordinance), and who considered the skeleton construction less stable than the old-fashioned masonry walls. Because these masonry walls were heavier than those of the skeleton construction, the ordinance assumed that the common masonry construction was the more substantial, while the contrary is the case. The skeleton construction is put together with hot rivets. Every part is carefully calculated, every possible stress is provided for by a proper

resistance, with all the care and all the science that would be applied to a cantilever railroad bridge over the falls of Niagara. The skeleton construction closely resembles steel bridges standing on end.

The Monadnock building, Chicago, is very long north and south, while the width east and west is only some 80 feet; the height is sixteen stories — over 150 feet. The north half of the building was built before the south half, and is of the old-fashioned masonry construction, with walls some five feet thick in lowest story. At this time the skeleton construction was in its infancy, and the owners, who resided in Boston, thought it

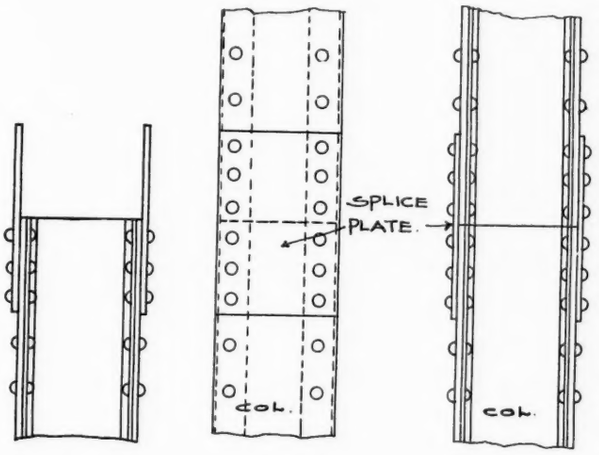


FIG. 6.

an experiment that it was not as yet advisable to adopt. Later, when the south half was built, the skeleton construction was used. Here was an excellent opportunity to compare the two systems.

The cost of the north half, old-fashioned masonry construction, was 42 cents per cubic foot, while the skeleton cost but 39 cents, the number of feet calculated from bottom of footings to top of roof with the space under sidewalks added.

The agent, desirous of settling the question of relative stability, employed some experts to make the test whenever a favorable opportunity arrived. This soon occurred, when a gale blowing from the east, of extraordinary severity, lasted some three days. The experts reported that the maximum vibration at top of cornice varied from the perpendicular about ⅜ of an inch — that it was a little more in the masonry construction than in the skeleton, and that there was less apparent jar in the skeleton than in the masonry portion.

It may be safely asserted that the steel skeleton construction, in the hands of experienced experts, is cyclone-proof, earthquake-proof, lightning-proof and fireproof. The entire skeleton is a lightning protector assembled together so intimately that the lightning striking the building is carried off harmlessly. During a heavy thunderstorm the Home Insurance building, Chicago, was struck on the northeast or alley corner. The only apparent effect was the tearing off of a few brick that covered the top of the column at that point. The writer was in the top story of the building at the time and experienced no sensation of the shock.

In a locality liable to earthquakes the exterior covering, which had best be of terra-cotta, should be very securely anchored to the steel, so as not to be easily shaken off. Unless the shock was very severe the building would not be injured.

Where the building is to be filled with inflammable goods, special care should be taken with the fireproofing particularly, to prevent its being stripped off by the shock of the water thrown by the fire engines.

FIREPROOFING.

The most usual fireproofing for stores, warehouses, bank and office buildings, and for tall buildings in general, is the hollow tile arches, end construction — that is, the resistance is in the direction of the webs, or subdivisions. The tile should be laid in strong Portland cement mortar; one to three is recommended. Every joint must be filled or there will be cracks in the plastering along the lines of the partially filled joints, as has occurred in so many buildings.

For hotels, apartment houses and dwellings, where wind bracing is not essential, the Roebling, the Expanded Metal and Concrete and other similar fireproofing systems may be used, particularly if the horizontal area of the building is large in proportion to the height, for these systems do not give the same rigidity to the floors as obtains with the tile arches. They are, however, of light weight, and allow of a corresponding reduction in weight of steel construction. Under favorable circumstances these systems will probably effect a reduction in cost.

Where concrete floors are admissible the concrete on top of the floor construction is finished off smooth with strong concrete, one of Portland to one of clean sharp sand, or better, crushed granite or crushed quartz. Where wooden floors are used wooden floor strips are laid, say, 1¾ inches thick, about 12 inches from centers. Formerly these strips were cut, dovetailed and filled in between with concrete, both to hold the strips and to fill the space between the strips. A difficulty was experienced; the floor strips would shrink and strips loosen, and the concrete filling would not become sufficiently dry before floor was laid, causing the swelling of the floor, which in office buildings and stores was usually maple. This maple floor was often seriously injured by the dampness in the concrete filling.

The writer has induced an insulating company of Chicago to prepare a pad composed of their insulating material — special mineral wool and asbestos, compressed to the proper width and thickness — to just fill the space between the floor strips,

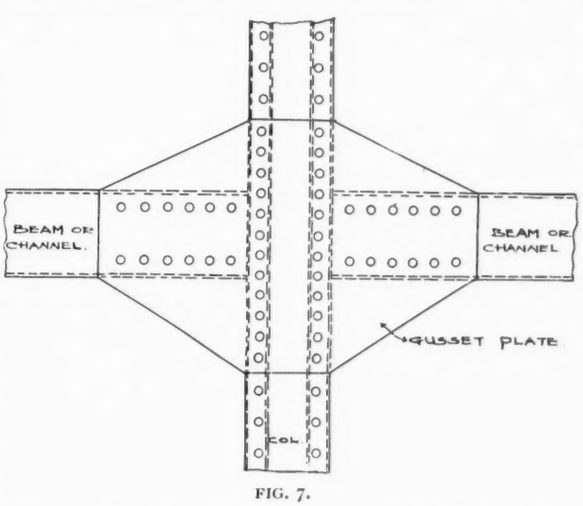


FIG. 7.

which are clamped to the floor beams. This is found to serve an admirable purpose, and the small additional cost is not to be considered, as compared to the advantages of a fine floor and thorough insulating and deafening; in fact, it is a saving whenever it would otherwise have been necessary to repair and in part relay the maple floor, as has been the case where haste in laying the hardwood floors was essential.

PARTITIONS.

The usual partition has heretofore been hollow tile three or four inches thick, according to the height. At the present time many partitions are made by setting up light steel channels ¾ to 1½ inches or more, in proportion to the height and use.

On one side of these channels expanded-metal or wire lathing is attached and plastered, and the other side is filled in with concrete and plastered, making a solid partition of about 1½ to 2 inches in thickness. These partitions are sometimes set double. Then the concrete filling is omitted and the exposed surfaces plastered on metal lathing.

Whatever system is used it should be tested by heating an experimental piece to redness and then plunging in water.

Several kinds of tile have been manufactured from plaster of paris, but as far as I have tested them they will not stand the test of heat and water. It is necessary that, in case of a fire, they should not only resist the fire but the fire department at the same time. At the great Pittsburg fire, some two years ago, the inspectors reported that large areas of partitions had disappeared before the fire department, leaving very little debris. The firemen testified that the partitions seemed to blow away when struck by the water.

Fireproofing of columns may be either by tile or by expanded or other metal lathing. If of tile, the tile is molded to fit the column, for which a full-sized section is made. These tile may be single or double according to the fire resistance required. It is very essential that the tile be so substantially secured that it will not be knocked off by the shock of the water during a fire. At the Pittsburg fire about one-half of the column coverings were stripped off; still the rigid inspection after the fire failed to detect any serious injury to the columns. It is probable that the fireproofing was stripped off the columns when struck by the stream of water from the fire engine, and from that time was constantly subjected to a deluge of water that prevented any overheating.

Columns are also fireproofed by wrapping expanded-metal or other metal lathing around the column and plastering. Then a furring system is put on and another layer of metal lathing and plastering. This, if well done, is probably safer than a single layer of hollow tile as usually put on. It is good practice to fill the columns and the stools with concrete, well rammed in place as the columns are set. This prevents interior rusting and strengthens the columns.

It is often desirable to run the water-supply and the waste pipes for the plumbing of the offices along the columns in the fireproofing. A full-size section should be prepared for the fireproofing and for the plumbing contractors.

The supply and waste pipes of the principal toilet rooms can usually be run in a channel in the wall of the building. In either case, arrangements must be provided for reaching these pipes whenever required. Steam pipes are often run in the same pockets with the plumbing pipes, for they are unsightly and objectionable when exposed in the rooms. All plumbing fixtures should be the best the market affords, and all work, both for plumbing and steam, should be the best and most substantial. It is a serious mistake to attempt to economize at the expense of quality or durability. Great reliance must be placed upon the contractors for this work. It should be stipulated that a reliable foreman should be constantly on the work, or, better still, the owner should employ an expert plumber, steamfitter and electrician to keep the closest watch on the work in his interest, for the opportunity for covering up bad work is abundant. Often this bad work is only found out when too late to obtain any redress from the contractor. The guarantee may have expired or the contractor may have gone out of business, or left the city. The only safety is to have the work done right in the first instance.

For the electric work the owner would certainly do well to employ an expert to assist his architect, for the whole subject is so new, and often so obscure, that the architect can not be expected to be "up to date" in all particulars. Neither he nor his superintendent can be expected to know if the details of workmanship are in accord with the specifications, nor can they be expected to make the tests from time to time as work progresses. If the building has its own electric plant an expert should assist the architect in locating the plant, and in the specifications for the dynamos, engines, etc. It is not well to rely upon one dynamo for the entire work when running at its maximum capacity; it is best to have two or three of different power, so arranged as to be switched into and out of use without disturbing the lights.

THE SHONE EJECTOR.

It is often the case that the basement or subbasement floors are below the city sewerage. In that case the drainage and the plumbing and steam wastes of the lower story must be collected and lifted into the street sewer. This is usually done by the Shone Ejector, that may be operated by either steam or electricity. There is another sewerage lift that has recently come on the market that under certain circumstances may be desirable. The architect would do well to study the two systems and see which, all things considered, is best adapted to the case in question.

VAULTS.

Should safety deposit vaults be contemplated they should be located and the effect on the foundations be provided for; the same for the bank vaults.

The office vaults are light and can be placed wherever convenient. The floors of these vaults should be of concrete or tile; the surface at level of the floor of the room, particularly if room floor is of wood, that the burning of the wood floor may not enter the vault. These office vaults are made the same as the partitions, either of tile or of channels and expanded metal, plastered on inside and concreted on the outside. The roof is made of T-iron, holding book tile, that is plastered on both sides. The doors are a light fireproof vault door about two feet wide with a vestibule.

ELEVATORS.

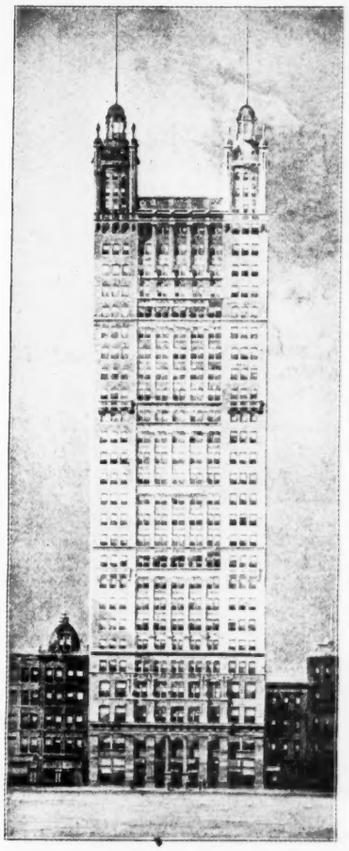
The tall buildings made the elevators an absolute necessity, and the first skeleton construction building, the Home Insurance building of Chicago, called for an elevator system such as did not exist at the time, and which was built from new patterns for this purpose by the Hale Elevator Company. Those elevators have been installed some fifteen years and are in excellent condition at present writing. They were of the vertical cylinder, hydraulic type, a cylinder shaft being constructed by the side of the elevators. Everything was so new that the Worthington pump used was soon found to be inadequate, although the selection of the pump used was left to Mr. Hale and Mr. Worthington, the owners agreeing to pay a fair price for whatever pump they should order used.

The writer, who was the architect, desired metal cars. Mr. Hale thought it impracticable to make metal cars that would not be too heavy. With the assistance of Poulson & Eger, of New York, cars were produced that were materially lighter than any wooden cars in use; in fact they were in part too light, so that they were replaced after twelve years of use, much to the regret of the writer, who was not consulted and only knew what was being done when he saw the new cars in the elevator shafts. He would have rebuilt the old original cars; being the first of their kind they had a historical interest. Since that time, when the elevators were put into the first steel skeleton building, but little change has been made in the hydraulic elevator plants. The electric elevators have made a great advance and have been greatly improved and are now coming into use. For buildings where it is economy not to run steam engines and steam pumps during the summer months, heating in the winter by the low-pressure system, electric elevators taking the current from the street are certainly desirable. They are well adapted to apartment houses and private residences, and it is now claimed that they can be advantageously used in buildings that have their own electric plant, using steam to manufacture electricity instead of pumping water.

PLASTERING.

For various reasons it is desirable to plaster with one of the hard plasters that should be mixed with sand at the factory. This will insure much greater uniformity than can be obtained

MASONIC TEMPLE, CHICAGO.
Burnham & Root, Architects.



SYNDICATE BUILDING, NEW YORK.
R. H. Robertson, Architect.

MONADNOCK BUILDING, CHICAGO.
Holabird & Roche, Architects. Burnham & Root, Architects.

EMPIRE BUILDING, NEW YORK.
Kimball & Thompson, Architects.

SOME NINETEENTH CENTURY GIANTS.

if the plasterers mix the sand with the plaster. The old method of slaking the lime at the building is difficult, as there is no convenient place for the mortar boxes. In these buildings all the trades are pushing their work as rapidly as circumstances will admit. The cost of these buildings is so large that the interest on the investment is an important expenditure. It is usual to obtain possession on May 1, or soon after, and the building must be completed by April 30 following, so that every arrangement must be made for rapid work. Mortar boxes anywhere within the building are in the way of other contractors. It seldom happens that there is any space outside the building that could be used for the mixing of mortar so that the use of the hard plaster mixed at the factory has become the rule. There is one of these plasters that requires particular notice — the so-called "Asbestic." It is composed of lime mixed with asbestos, sometimes with Portland cement added. It has the quality of resisting the effects of fire and adhering to the lathing or brickwork with a tenacity not otherwise obtained. As a nonconductor it leaves little to desire, and should be used in warehouses where an excessively hot fire is possible. By the addition of Portland cement it can be made sufficiently hard to resist the severe usage likely to obtain in a warehouse. This is particularly desirable for columns.

MARBLE TILE OR MOSAIC FLOORS.

All the halls and the public parts of the bank and the large offices should have floors of something more lasting and better adapted to hard usage than wood. A very serviceable tile floor is manufactured in Chicago. The tile are made by mixing marble chips with the best Portland cement in an iron mold. This mixture is submitted to a pressure of 2,000 pounds to the square inch. When set sufficient to handle, the tile is removed from the mold and put in a rack in a room arranged for the purpose, when it is subjected to a spray of water for thirty days. The tile is then put on the rubbing board and ground to a fine even surface. As the metal mold is made with perfect accuracy, the tiles are interchangeable and lay with exceedingly fine joints. The method of manufacture assures the greatest durability obtainable with any material other than metal.

Marble tile, usually about 12 by 24 inches, and mosaics, either of marble or ceramic, are much used. Mosaics have the objection of adhering together over considerable areas and letting go at the weakest part, causing large unsightly cracks. These are due to the shrinkage of the cement mortar in which the mosaic tesseræ are laid. The repairs, as usually made, are unsightly. This is not a necessity, for if tesseræ of proper size to fill the crack are used, and the repairs made with skill, cutting out the cracks for a considerable width, that the increased size of the new tesseræ may be very small, the repairs would not be noticeable.

ORNAMENTAL METAL-WORK.

Consisting of elevator or gallery fronts, elevator cars, exterior framework, usually for store or first story and for the second story, and for the doors of the first and second stories, and possibly to some of the large offices.

This ornamental metal-work is best of statuary bronze, certainly for the exterior. For the interior it can be either real bronze, electroplate, Bower-Barff, or painted iron, according to the price the owner is willing to pay. The designs should be artistic. Some excellent results in elevator work have been obtained in wrought iron. There is lying on the table before the writer a copy of a La France rose in wrought iron, that if the artistic critic did not praise without qualification, he would say that it was too exactly like a real rose — that it might be more conventional. Those who visited the World's Fair will doubtless remember the artistic display of wrought-iron work from Germany and from Chicago.

A metal covering for doors, window frame and sash of very good quality is now being manufactured, and is coming into use as a neat and not too expensive method of making doors and windows fireproof. If these windows are glazed with what is termed wire glass or with the Luxfer Prism metallic glazing, they are accepted by the Board of Underwriters as fireproof.

For further investigation, see

FOUNDATIONS.—*Eng. Rec.*, March 3, 1894. In Amn. Surety Bldg., New York, *Eng. Rec.*, July 14, 1894. Brick Well Piers, *Eng. Rec.*, Oct. 27, 1894. Deep Pile, Technograph, Univ. of Ill., 1892. Testing Soils, etc., *Amn. Arch.*, Sept. 23, 1893. On Compressible Soil, *Inland Arch.*, Vol. VI, p. 100; Vol. VIII, p. 69; Vol. XI, p. 31; Vol. XVIII, p. 41.

STEEL FRAME CONSTRUCTION.—Wrt. Iron and Steel Tests, *Trans. A. I. M. E.*, 1892. Specifications, *Eng. News*, Feb. 14, 1895. In Large Buildings, *Jour. Assn. Eng. Socs.*, March, 1895. Steel and Iron Construction, *Inland Arch.*, Vol. XIX, p. 59; Vol. XXVI, p. 47; Vol. XXX, p. 56. In Boston, *Builders' Weekly*, Worcester, Feb. 18, 1899.

DEVELOPMENT OF THE FIREPROOFING OF BUILDINGS.

BY PETER B. WIGHT, ARCHITECT.

THE art of building at the present day has been brought up to such a high standard of excellence that no structure can be considered to be of the best class unless every improvement that scientific investigation and experiment have developed in the direction of protecting it from the destructive effects of fire has been embodied in its construction. The use of iron as a substitute for wood for all constructive purposes was long thought to be an advance in this direction. Iron not only supplanted timber, but took the places where formerly masonry of various kinds, such as brick for piers and stone for both piers and lintels, was employed. Hence, when it was discovered that iron of all kinds was unreliable if exposed to temperatures of 900° Fahr. and over, the danger to so-called fireproof buildings, in which only an incombustible material had been so extensively introduced, was much greater than to those which had been previously erected without any regard to protection from the effects of fire. In several instances this effect was a complete collapse. The use of iron was also extended to its substitution for stone in the fronts of buildings, and the mania for this kind of architecture continued from 1855 to 1870. It was not always cheaper than stone or marble though the facility with which elaborate patterns could be produced made it possible to erect very ornamental fronts for less than the same design would cost in those materials, while if the treatment was very plain and simple the cost was greater. The main reason given for introducing this innovation was that such fronts were incombustible, and superior to stone or marble, which would chip or crack when heated and thus be destroyed as far as its monetary value was concerned, even though it did not fall. But after a few cases in which these iron fronts were affected by fire it was found that they would generally come down after slight exposure and cause a total loss.

These failures helped to call attention to the danger of using unprotected iron for all purposes. After 1870 cast-iron fronts began to be less favored, and at the same time some thoughtful investigators began to direct attention to the necessity for protecting rather than discarding the use of iron for constructive purposes. The chiefs of fire departments everywhere and some insurance authorities began to wage a warfare against constructive iron and demanded the return to wood. But they were not inventors. In course of time many inventors were at work, and though the use of protection for iron construction has been but slowly adopted, the necessity for it has been generally recognized within the last few years. So that it may be said that the inventors of fire-protecting methods for constructive iron and steel, as well as of fireproof constructions in connection with these materials, have saved from anathema and encouraged the growth of one of the greatest industries of the country.

As soon as fire protection in connection with constructive steel became an accomplished fact the improvement of both of these arts went on hand in hand, and the development of the capacity of steel for building purposes has been no less remarkable than that of the fireproofing systems used in connection

with it. The now generally used steel skeleton construction is the principal result. It is almost universally used for buildings exceeding one hundred feet in height, and there is some prospect that it may be largely adopted where the "high building" problem is not a factor to be taken into consideration. The experiment is now being tried in many places of its application to other than high buildings, and wherever it is the services of the "fireproofer" are indispensable. Its applications are multifarious, and even where it does not appear in the external walls, many buildings are being erected in which it is used throughout the interior for economy of space, and often, it is

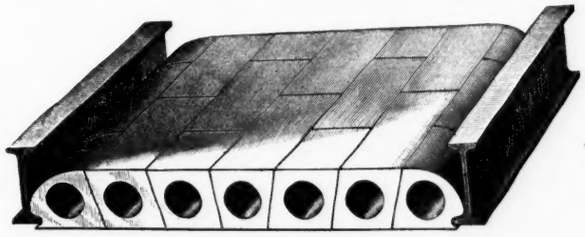


FIG. 1.

found, with economy of cost. Its influence on architectural design is not to be here considered, but will soon have to be recognized.

When iron began to take the place of wood for constructive purposes, which was in 1854, just before the cast-iron fronts were introduced, the only fire-resisting material known was the common brick, which was just what it is now, though now made by more economic methods. The only new use for bricks in those days was the construction of segment arches between the I-beams of the floors, and the idea was taken from the barrel vaults of the Romans which had continued to be used in many public buildings during the first half of this century. Then corrugated iron arches were sometimes used with concrete filling over them, which it was claimed at the time would lead to economy in dispensing with the necessity for using a centering under the brick arches and plastering their under surfaces. All sorts of devices were used for building incombustible partitions in such buildings, but no reliable method ever came into general use. It was sought to divide the buildings into rooms as far as possible with permanent brick partitions built up from the foundations, and in some cases built on extra heavy beams inserted for the purpose. These had to be provided for in the original plans of the buildings, and once built they could not be changed without great

FIG. 2.

expense. The extensive use of brick partitions in such buildings was an element of safety against the extension of fire, which was to a certain extent in their favor and made them safer than if built with open construction like the modern steel skeleton buildings. This system of subdivision with brick walls being no longer used, the problem for the modern architect and the fireproofer has become thereby more complicated. But it is being solved every day by the subdivision of buildings with reliable hollow partitions.

Criticisms of the buildings which had been erected with simply incombustible construction began to be heard in 1871 after the great Chicago fire, many of which were destroyed at that time. But the alarm was heard about the same time in England, where several so-called fireproof mills and warehouses were destroyed. The first valuable improvements were made in fireproofing cast-iron columns in 1875 to 1879. This was done according to a method patented by the writer with porous terra-cotta, used in blocks, hand-made. Soon after this, in many buildings rolled iron I-beam girders were fireproofed with porous terra-cotta. The first iron roof trusses of which the individual parts were covered with porous terra-cotta are in the Board of Trade at Milwaukee. They were done about 1878. These were the beginnings of the protection of structural iron. But improvements in floor construction with a view to relieving the floors of weight were made before this time. The first use of hollow burned tiles for this purpose, in the United States, was made by the late George H. Johnson, of Chicago. They were built in one of the corridors of the New York postoffice in 1873, an illustration of which from an old circular is here given (Fig. 1). About the same time Mr. Johnson—whose son E. V. Johnson was one of the founders of the Pioneer Fireproof Construction Company, and is now secretary of the Illinois Valley Clay Company—used a similar floor construction in the Kendall building at Chicago, the Singer building at St. Louis, and several others of less note.

Shortly after this, George H. Johnson died. The contract for the fireproof work of the Chicago City Hall was one of the first in which the fireproof protection of the columns and girders was combined with a floor construction of I-beams and flat hollow tile arches. The contract was awarded in 1879.

Upon The Pioneer Fireproof Construction Company, The Wight Fireproofing Company, The Illinois Terra Cotta Lumber Company, The Illinois Valley Clay Company, and their experts, has devolved the main responsibility of building the new fireproof Chicago. It is safe to say that all the improve-

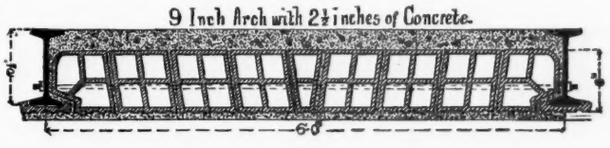


FIG. 3.

ments in the manufacture and use for fireproofing purposes of burned fire clay between 1879 and 1885 were made by the experts of the two companies first named.

The Pioneer Company had used mainly in their business hollow tiles of hard-burned fire clay, up to a year ago, when they discovered how their own clay product could be made semi-porous. Since then they have made the semi-porous body entirely. It stands between hard tile and porous terra-cotta in density, and for that reason it is not liable to crack if water is thrown on it when the material is heated to a high degree. The Wight Fireproofing Company always made a specialty of porous terra-cotta for constructive iron and steel work and hard fire-clay hollow tiles for floor arches and partitions. The Illinois Terra Cotta Lumber Company has always made and used porous terra-cotta for all purposes, the body of the material being made with a large proportion of sawdust, which is burned out in firing, leaving the material extremely light. Porous terra-cotta when made in hollow tiles combines the non-conductivity of the air spaces with the same quality in the body of the material. The Illinois Valley Clay Company uses both hard hollow tile and porous terra-cotta in its work.

The Montauk was the first high building erected exclusively for office purposes in Chicago. It was built in 1881-2, and in height is just within the limit of 130 feet now fixed by law, beyond which a building shall not go in Chicago. All the floors and roof are of hard, hollow flat arches between the 8-inch I-beams. The arches are six inches deep and made of the best fire clay, to order, and with special reference to saving weight. A section of one of these floor arches is here given (Fig. 2). The cast-iron columns and the I-beam girders

are all fireproofed with solid blocks of porous terra-cotta, the blocks being secured to the columns with iron screws tapped into their flanges, and having large washers buried one inch deep into the porous terra-cotta, as originally patented. The partitions are all built of 3½-inch hard hollow tiles. This is the first building in which railroad iron combined with concrete was ever used for the offsets in the foundations, and the first in which the walls of an adjoining building were held on screws during its erection, and the screws adjusted to its settlement. The floor arches, which weighed 25 pounds per superficial foot, were the lightest that had ever been placed in any building, and no lighter ones have ever been made since.

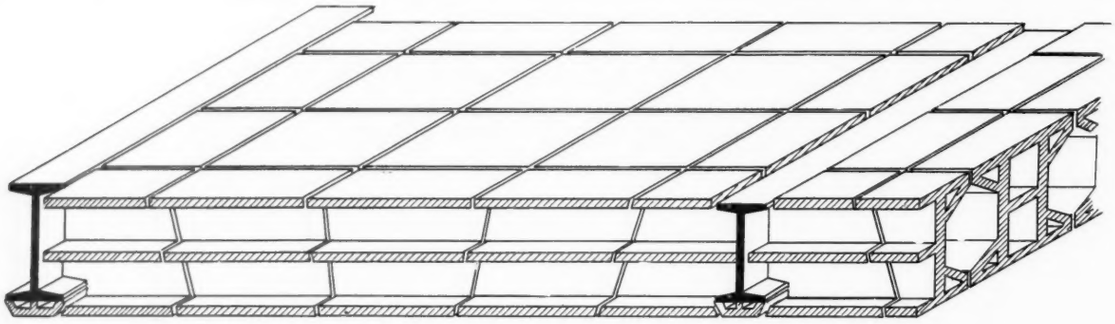


FIG. 4.

Isometrical View. Hollow Transverse System. Arch Tile.

The exterior walls and main partitions were built of brick from the foundation to the top.

Since the erection of this building all the improvements in the construction and fireproofing of high buildings have been made step by step.

In 1884 the Mutual Life Building, on Nassau street, New York, was fireproofed throughout with porous terra-cotta and hollow fire-clay tiles, by the Wight Company, of Chicago. This is the first building in which the under sides of the beams were ever covered by fire-clay tiles for the protection of the same from fire, and leaving a flush ceiling. Shortly after this, and in the same year, the beams of the Stillman Apartment House, at Cleveland, Ohio, were covered by tiles, and a flush ceiling made with tiles, by the Pioneer Company, of Chicago. Since then all the floor arches set by Chicago fireproofers have been with tile protection to the beams. The method of doing this in the Mutual Life Building is here shown (Fig. 3).

The remarkable advance made by all of these companies is now seen in the hundred or more immense buildings of Chicago and elsewhere which have been erected during the last fifteen years. These have attracted the attention not only of the architects and the public of other cities, but throughout the world, even in far-off Japan; for the drawings for the steel skeletons of a public building in that country are now being made in Chicago.

It would be impracticable in the limits of this publication to describe all that has been done and is now being done to make buildings fireproof in reality. Only a few of the latest improvements can be mentioned or described. Suffice it to say that Chicago has demonstrated to the fullest extent the great value of burned clay as a fireproofing material. But it is not alone the use of clay that makes the best buildings of the new Chicago fireproof, for not all clays are valuable for this purpose. Most of the clays can only be burned at a comparatively low temperature. If subjected to high burning they vitrify and melt. Vitrification or fusing just below the melting point is desirable for some purposes, as in the making of table ware or paving brick; but clay used for fireproofing purposes should sustain a temperature of from 2,500 to 3,000 degrees without vitrifying. It is liable to be subjected to these temperatures in burning buildings. In making hard tile the clay is used pure, with the admixture of a small portion of "grog" or refuse tile that has been ground to powder, and sometimes, but rarely, a little sand. It is burned just up to the vitrifying point. Such tile is valuable for fireproofing purposes in proportion to its toughness as opposed to its brittleness. The toughness is increased in some fire clays by the admixture of a certain proportion of shale, or clay that has been converted by natural pressure into a soft stone.

Porous terra-cotta is made by mixing sawdust with an equal bulk of clay. No high-grade fire clay can be made into porous terra-cotta, because the best fire clays are too brittle. Neither can any common clay be used, because the increased heat caused by burning out the sawdust would melt it. Hence porous terra-cotta is always made either with semi-fire clays or low-grade fire clays, which are useful for few other purposes, and which are best for this purpose; or by using common clay mixed with fire clay. The toughness is the important quality in the product. The fact that the sawdust is always burned out is a guarantee that it has been fired at a high temperature, but its strength is only imparted by the quality of material used.

Semi-porous tile is generally made by the admixture of a small quantity of ground coal. The fact that this is used is a guarantee that it has sustained a higher temperature in burning than porous terra-cotta, because the coal requires a higher temperature and is more closely confined in the clay.

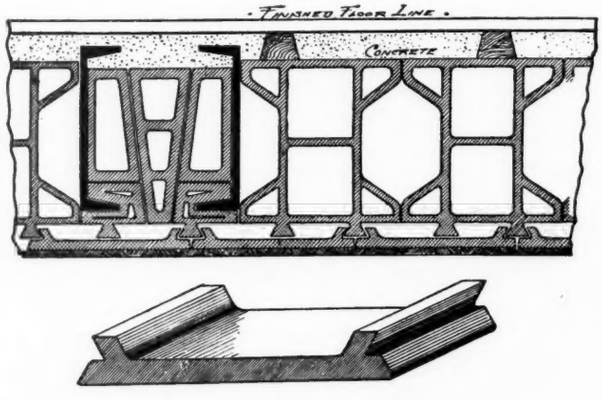


FIG. 5.

It was once thought by architects that most fireproofing methods were covered by patents which made them expensive, and they used to sigh for the time when clay fireproofing would become so cheap that it could be used in all buildings. This was a mistaken idea. While there were patents covering certain applications, most of the work has been done in ways that they did not apply to, and there are but few patents that have

not expired. It is safe to say that patents never increased the cost of fireproofing work, for competition between opposing patented methods has kept the prices down. The necessity for manufacturing cheaply to meet this competition, and to put the materials on the market at prices that were not prohibitory, has compelled the largest manufacturers to make their wares where the clay is found, and consequently no fireproofing material can be made for a price that will cause a demand for it

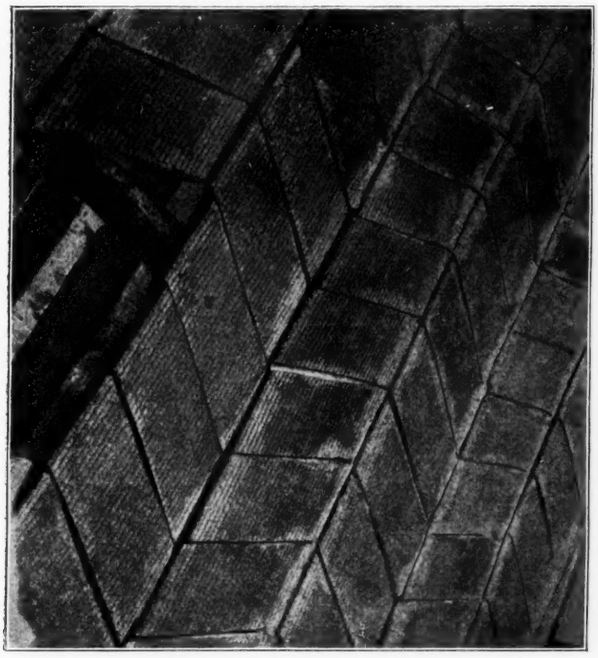
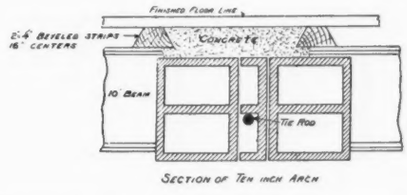


FIG. 6.

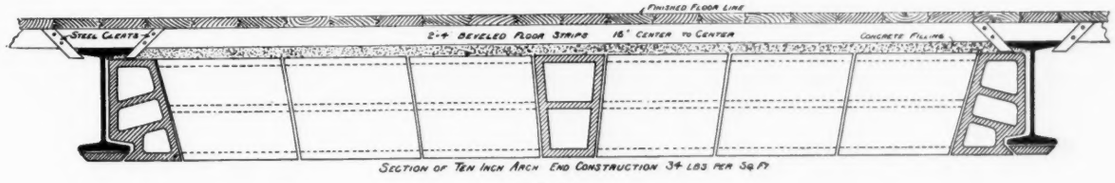
unless the clay is found and the goods are made at points where the transportation to the main points of consumption is ample and cheap. For this reason, if a manufacturer should desire to make a superior article by combining clays from distant points, as is the case with all fine table wares, it would increase the cost considerably. Whenever the ideal clay fireproofing is made so as to meet every test that the scientists may give it, it will certainly be a more expensive article than those now in general use, if clays from distant points are combined to make it.

It must be remembered, also, that each manufacturer has his own special forms and methods of construction, and that there is opportunity to discriminate between them. All can not comply with one specification exactly, and if the material were always made exactly as the architect specifies it, the cost would be increased. Hence each manufacturer is an expert in his own line, and should be regarded as such. This has always been the case west of the seaboard cities. There for many years the makers of clay fireproofing all manufactured practically the same articles, being certain stock patterns which were handled and used by the contractors in whatever way the architects specified them. In Chicago the leading men in the fireproofing business are experts. The value of their work depends upon their special forms and methods of construction, attachment and fastening.

There is only space enough herein to illustrate some of those which are most recent, and as this article is not altogether historical, a long period of improvement in floor construction must be passed over until we come to the latest developments of the art of fireproof floor construction in steel and burned clay. As showing the latest work of the Pioneer Fireproof Construction Company, Fig. 4 is introduced. This is an end-pressure arch of the simplest construction. Only one form of tile is used for the arch and one for the beam soffit. The latter is 1½ inches thick, with air space next to the beam of ¾-inch. The arch tile is cut into as many pieces as desired, the joints radiating from a common center. The skewback tiles are cut also to the section of the I-beam when the soffit is under it. The tiles are semi-porous. The latest invention of the Pioneer Company is an end-pressure arch, the underside of which is not only below the beams, but also below the girders. The soffit of the entire arch after construction is covered with loose tiles. The latter are to receive the brunt of the fire attack before it can affect the integrity of the arch itself. This system is illustrated by Fig. 5, which is a cross section of the girder and longitudinal section of the flat arch, it being understood that the beams abut against the sides of the girder, which in this case is a double channel, similar to that used in the extension of the New York Life building, Chicago. One of the movable tiles used to form the suspended ceiling is seen below the section, and we are looking at the top of it. The tiles forming the flat arches and the girder covering are run out through the die in such manner as to leave dovetail lugs on the bottom. When the work is set these lugs always come in straight lines at even distances. The ceiling tiles, which have been burned in couples, previously cut in lozenge form and then split apart after burning, are inserted between the lugs with ordinary mortar joints so as to form a continuous ceiling. This is shown in Fig. 6, which is taken from a photograph of a piece of construction of this kind that has been tested by fire, in the testing house of the Pioneer Company at Ottawa, Illinois. In this test none of the tiles were broken or displaced. Those removed in the picture are to show the bottom of the arch tiles. This system of ceiling construction was suggested by the experience of several actual fires. In many cases, while the integrity of the floor arches has been maintained, the bottoms have cracked off, necessitating the replacing of the arches to make acceptable repairs. It has also been observed in several severe fires that ceilings made of tiles that have been made in twos, and split after burning, never crack when exposed to fire and water. It was thought, therefore, that such a ceiling suspended in such a simple way below a flat, hollow-tile arch without metallic fastenings would fulfill the requirements of absolute and unfailing fireproofing. This has already been established by private tests, but it remains for



Section of Ten inch Arch



Section of Ten Inch Arch End Construction 34 Lbs per Sq Ft

FIG. 7.

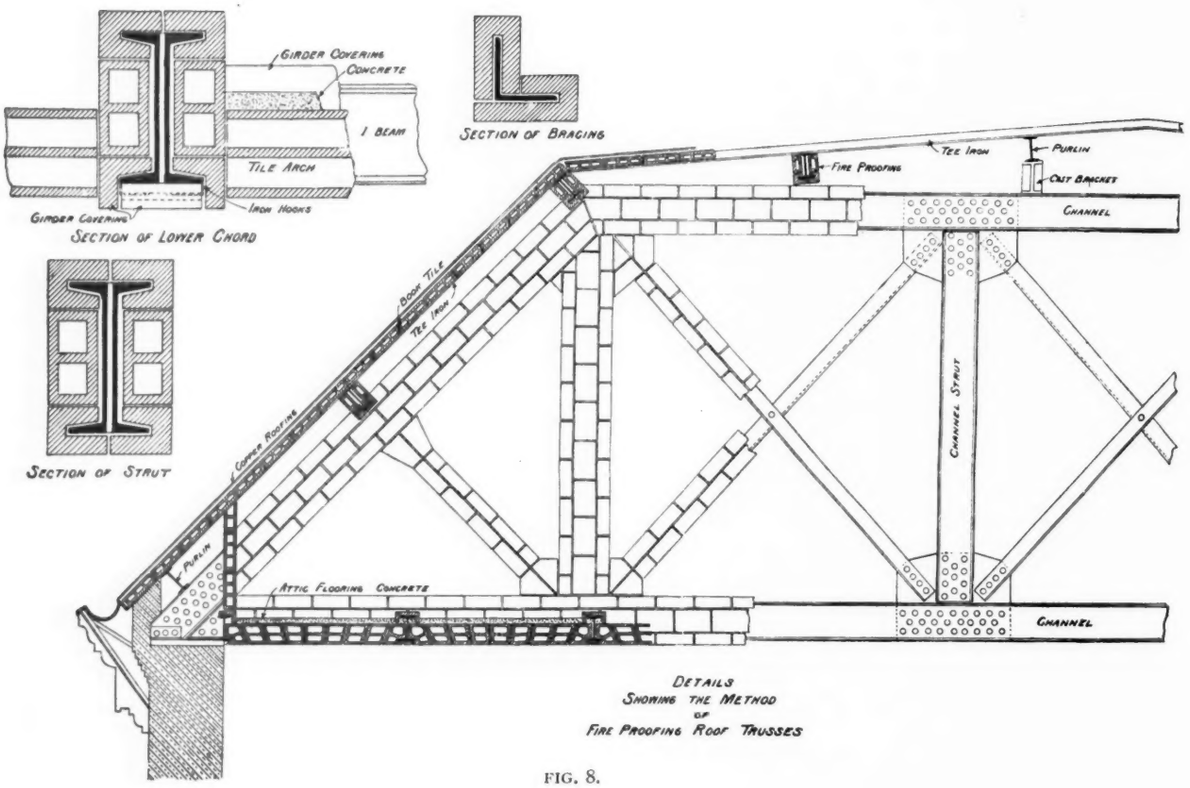


FIG. 8.

some one who is willing to pay very little extra for ideal fireproofing to put it into practice.

Two sections of the latest improved end-pressure floor arch of the Illinois Terra Cotta Lumber Company are given in Fig. 7. This is so plain as hardly to need description. As showing one of the most scientific methods of fireproofing constructive steel work with porous terra-cotta, an illustration is given (Fig. 8) which is a working drawing of a roof truss fireproofed by the Illinois Terra Cotta Lumber Company. In this the porous terra-cotta is made in such shapes that when set in cement it is self-supporting; but whenever it is necessary, as in parts subject to vibration, the tiles are bound in place by wires. These are protected by a coat of cement over the whole surface, which is applied when the tiles are wet.

For further investigation see *The Inland Architect*, Chicago, for March, April, May, June, July, 1892; June, 1893.
The Brickbuilder, Boston, for March, June, July, 1898.
The publications of the British Fire Prevention Committee, London, Nos. 1, 2, 7, 10, 11.
Journal Association Engineering Societies, Philadelphia, March, 1893.
Engineering Record, New York, May 7, 1892; May 26, 1894; June 25, 1898.
Journal Society of Arts, London, July 8, 1892.
Architecture and Building, New York, May 28, 1898.
Iron Age, New York, June 30, 1892.
Engineering News, New York, April 13, 1893; January 24, 1895.

HYDRAULIC CEMENTS.

BY WILLIAM S. MACHARG, C.E.

THE application of hydraulic cements in building construction has increased of late years to such an extent that its manufacture is becoming one of the great industries of the country. This increase is by no means due to its use to a larger extent in the class of work to which it was originally applied, but rather to invasion of new fields, and to the displacement of other materials.

Originally used as a binding material in stone or brick masonry in subaqueous work or in work exposed to the action of water, it has now, in many structures, displaced the former principal components, or rather combined them in a less costly, but integral form, as concrete, furnishing a monolithic mass unattainable in ordinary masonry. In common structures, in foundations and in elaborate masses the primary plasticity of concrete and its ultimate great strength, equal or superior to that of most building stones, together with its monolithic character, make it an invaluable building material.

Recent combinations of concrete with steel tie-rods, beams, and especially plate girders, have opened a new field in the covering of large areas and building permanent bridges, which it is yet hard to value. An arch of concrete is much stronger than an equal arch of brick masonry, and an arch in which steel beams bent to the curvature of the intrados are imbedded in concrete is far stronger than the first. The relative strengths have not yet been accurately determined, probably because the field is new and the materials comparatively inexpensive, but these works are rapidly increasing in number and importance, and we shall soon undoubtedly have definite determinations of the economic values.

While hydraulic cements, perhaps both natural and artificial, were used by the ancients, yet the hydraulic cement of commerce is a modern discovery, dating back less than one hundred and fifty years. In the year 1756 John Smeaton, C.E., seeking for a proper mortar to be used in rebuilding in stone masonry the Eddystone lighthouse, which had been swept away, found that the quality of setting under water possessed by hydraulic limes was due to the presence in the limestone of clay, and secured the excellent mortar used in that structure by mixing blue lias hydraulic lime from Aberthaw and pozzuolana from Civita Vecchia. It was not until 1796, however, that a true hydraulic cement appeared, when Mr. Parker, of London, took out a patent for the manufacture of what he called "Roman" cement, which was made from septaria, nodules of natural cement rock, calcined and ground to powder. Other natural cements were found in Europe, and experiments were made in the production of artificial cement, and in 1824 an English patent was granted for "Portland" cement.

In the United States cement rock was first discovered and natural cement made in 1818 near Fayetteville, New York. Other cement rocks were discovered within a comparatively short period and the manufacture was commenced of many now well-known natural cements. It is of local interest to note that cement rock was discovered at Utica, Illinois, in the year 1838, and that cement has been made at that point continuously since.

The manufacture of Portland cement was attempted about 1865 by Mr. Saylor, in the Lehigh valley, but the work for some time was experimental, and while it continued a true Portland was made to a small extent at Kalamazoo, Michigan, in 1872. The growth of the industry was slow in the United States, as is shown in the following table made from official figures given by Mr. Robert W. Lesley, in the *Journal of the Franklin Institute*, November, 1898, of the amount and origin of the Portland cement used in this country, years showing marked change in domestic being selected :

	American.	Foreign.	Total.
	Barrels.	Barrels.	Barrels.
1882	85,000	370,400	455,400
1885	150,000	554,396	704,396
1887	250,000	1,514,095	1,764,095
1892	547,440	2,440,654	2,981,094
1894	789,757	2,638,107	3,427,864
1896	1,543,023	2,989,597	4,532,620

From another source the figures for last year are taken, the quantity imported being approximate :

	American.	Foreign.	Total.
1898	3,698,248	2,000,000	5,698,248 bbls.

During the year 1898 there was also manufactured in the United States 8,276,424 barrels of natural cement.

While the manufacture of American Portland cement has increased so rapidly during the last few years as to shut out foreign cements largely except in seaboard cities, the demand has been such that derangement in transportation facilities has often produced local shortages of supply. As a result many new mills are being erected throughout the country.

The past twenty-five years has seen a great improvement in the quality of Portland cement, due in part to the use of better machinery, and in part to the exercise of greater care in the selection and proportionment of materials, and these improvements have been brought about principally by the general and systematic examination and testing of the cements offered in the market. Cement testing has been made easy by the provision of special apparatus of little cost, and it is unusual now for any work using a considerable amount of cement to be carried on without continuous testing of the cement offered. A new class of mechanics has therefore come into existence known as cement testers. The term mechanics is used advisedly and without any invidious meaning. The manual and operative process of cement testing is purely mechanical, and attempts have been made to secure uniform results by regulating and fixing the steps in the process, and even by the introduction of machinery in the preparation of the test pieces. Uniformity is to some extent desirable, and yet this desirability is limited. As a building material hydraulic cement differs from all others, except lime, in this great and essential feature, that it is an unfinished product; that is, that after introduction into the structure it proceeds to its final office and state. This condition, together with allowable variation in its composition, renders the tests which are made to establish the quality of the unfinished material indicative tests and not proof tests.

Fortunately the large laboratories where cements are tested are in the control of persons qualified to pass judgment on these indicative tests, but there exists a danger in the common system of general testing which may bring serious injury upon the cement industry in this country. Taken in conjunction with the ordinary American desire for improvement, and the wish or necessity for quick returns on investments, mere mechanical testing—assuming that if certain qualities approved by tradition are good, the same qualities exhibited in a higher degree are better—may result in the production of a material which will eventually wreck many a well-planned structure.

The chemistry of hydraulic cements, both in the requirements of manufacture and in the final process of setting, are by no means agreed upon even by the eminent men who are making it their life study. Michaelis, Le Chatelier, and Newberry, with others, are gradually evolving a firm basis upon which manufacture may proceed with more certainty, but at the present time the only absolute proof test of an hydraulic cement is *time*.

It is in Portland cements that the danger spoken of is chiefly to be feared. Competition is fierce, and as the material is purely artificial, some added material being necessary even in the rock Portlands to secure correct proportions, demands by the consumer, even when not based on correct judgment, will be met by the manufacturer.

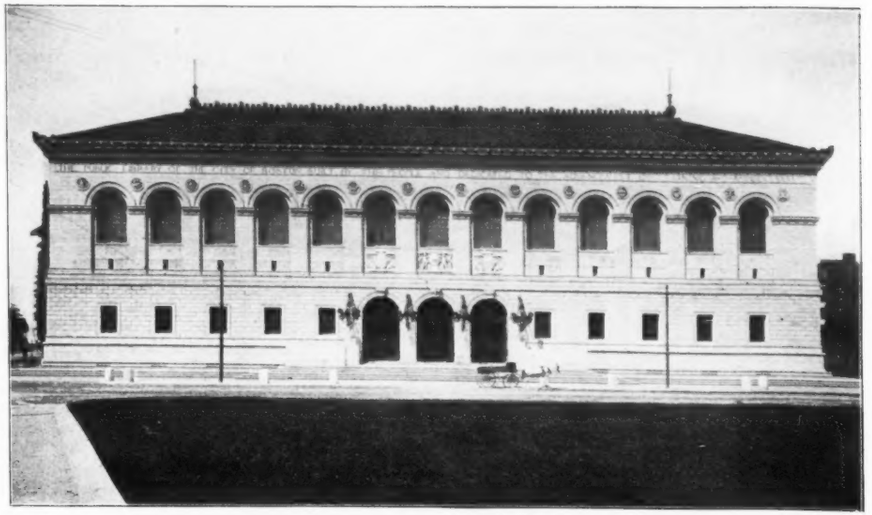
It must be borne in mind that the manufacture and use of Portland cement dates back only seventy-five years, and for a good many years its use was attended with many failures. Thirty years ago careful and judicious American engineers did not care to trust Portland cement concrete in important foundations or heavy structures. It was through the careful and intelligent work of Grant and Faija, largely, that English manufacturers were brought to recognize the need of care and exactness, and that certain brands of English Portland cement acquired a reputation for stability and other good qualities. A great impetus was given to the use of concrete by the building of Port Said, where this material was used exclusively; the binder, however, in the Port Said concrete was a natural product, the hydraulic lime of Teil. About this time the Germans entered upon the manufacture of Portland cement with their usual methodical care, and produced good material. As a consequence of all these conditions, concrete has advanced rapidly as a building material.

From the early successes and failures of Portland cement in mortars and concretes certain deductions were made which have become traditions, and, as in most traditions, the origin has become obscured. One of these traditions is that the slowest setting Portland cements are the best, and the class of testers above referred to accept this maxim without limitation, apparently without knowledge of its origin. The early users of Portland cement found from experience that cements which commenced setting very quickly, or which acquired a very great strength in a short time, say a week or less, were likely to "go back" or retrograde, and that this might even proceed to disintegration in time. They also noted that these qualities—that is, quick commencement of set and rapid continuance to great hardness—were apt to be combined in the same cement; hence the deduction. These conditions, singly or united, were an indication that either in proportioning the components or in the processes involved, something was wrong, and the cement likely to be unsafe.

At the present day, under the pressure of competition and under the warrant of testers, the early strength of cements is being gradually forced up, and the time of the apparent occurrence of initial set is being retarded by the admixture of gypsum. Why should the addition of two per cent of gypsum change the inherent qualities of a cement which would have been rejected thirty years ago on its abnormal strength at the age of seven days? What significance has the artificial delay of the initial set for two or three hours? If time is the only proof test of works in Portland cement, why should changes in method which may be vital be allowed to, or rather forced upon, manufacturers upon the sole warrant of mechanical laboratory tests?

There has been a considerable legitimate improvement in Portland cements within the past thirty years, and credit must be given for it to careful, intelligent study in laboratories, but there must be a distinction made between this study and the common inspection tests made upon work, and the influence of

AT MILWAUKEE.
Ferry & Clas, Architects.



AT BOSTON.
McKim, Mead & White, Architects.

AT CHICAGO.
Shepley, Rutan & Coolidge, Architects.

AT WASHINGTON.
Smithmeyer & Pelz, Paul J. Pelz, Edward P. Casey, Architects.

NOTEWORTHY LIBRARY BUILDINGS.

the latter upon manufacturers must be limited. Such limitation can only come from intelligent supervision, and it is upon architects and engineers that this responsibility rests.

The value of different qualities in Portland cement depends entirely upon how or where it is to be used. For instance, the extreme hardness attained by some cements in a short time is only valuable where the work is to be quickly exposed to abrasion. A driveway or walk is an example of such work, and this is easily and at small expense replaced if anything is wrong with the cement. In the case of footings in a large building, or foundations for heavy machinery, however, the cost of renewal includes vast expenses, and the original conditions do not require an extraordinary degree of strength or hardness in the cementing material, therefore stability should be the quality particularly sought, and indications possibly inimical to this quality should be given great weight in the selection of material. Engineers are beginning to realize this danger, and some recent specifications contain a limiting maximum strength at seven days which is much below that set forth as desirable in many American Portland cements.

CEMENT NOTES.

Of American Portland cement works, the Atlas plant is the largest, turning out in the neighborhood of 4,000 barrels a day. This cement is well known and highly appreciated; it was used in so far as it could be obtained in the construction of the heavy concrete work involved in the track elevation at Clark and Sixteenth streets, Chicago.

The Alpha plant is also very large, turning out about 3,000 barrels a day. This cement was one of the earliest of the Lehigh valley cements to come into the Chicago market, and has been used extensively, one of the largest works being the retaining walls for track elevation of the Lake Shore & Michigan Southern Railway at Sixty-third street, Chicago.

Giant cement, also from the Lehigh valley, is being used in the construction of the main conduit of the southern intercepting sewer system, on Thirty-ninth street, Chicago. This conduit is of horseshoe form, the horizontal diameter being twenty-two feet, and the lower section is of concrete.

The beautiful bridge lately built in Garfield Park, in this city, is of a type that will have an extensive use for permanent bridges. The type admits a combination of good design and great strength, being of steel beams imbedded in a monolith of concrete. In this bridge, Vulcanite cement was used, and the careful execution of the work has produced a fine example of this class of structures.

Among the natural cements there is none which has a higher reputation in the Western markets than Utica cement. This was first made over fifty years ago for use in building the Illinois and Michigan canal, and it has been used continuously since that time in all the public works of this city, and these bear witness to the value of this cement.

The use of concrete in floor construction in heavy fireproof structures is very common, but the heaviest concrete floor construction in this country is said to be that of the Gottfried Brewing Company's stable building, the average dimensions of the arches being 10 by 14 feet and 3 feet thick at the beam. In order to bring the weight of the arch upon the beams before the cement had fully set, in this instance a system of suspended centering was designed and patented, which has come into extensive use since, owing to its great convenience. Iron hangers acting on the principle of ice tongs, one end provided with jaws to clutch the lower flange of the beam, and the other end of each piece bent into a step to carry a joist, are set at proper intervals on the beams; the joists are set in position, carrying the sections of centering, which are thus forced up tightly against the bottom flanges of the beams from which they are hung, and as the concrete is rammed in place the weight is brought upon the beams. The centers are easily struck by disengaging the hangers, and the apparatus is exceedingly convenient for use.

A novel use for concrete is in the construction of tanks for boiling purposes. A set of three connected tanks, each 20 by 16 by 6 feet inside dimensions, has been built as a monolith for the Chicago Veneering Company, for the purpose of boiling large logs in their process of manufacture. Near the bottom in each section is a concrete shelf which protects the perforated steam pipe, which is run in the tank below the shelf, from injury by the logs as they are dumped into the tanks.

For further investigation, see

Mortar: Cost and Strength, Rep. Chf. Engrs. U. S. A., 1893, Vol. IV. Tests, Rep. Chf. Engrs. U. S. A., 1893, Vol. IV. Economics of Cement Mortars, *Eng. News*, Aug. 10, 1893. Effect of Frost on Green Masonry, *Eng. News*, March 26, 1894; Trans. Can. Soc. C. E., Jan.-June, 1894; *Eng. News*, May 2, 1895; Trans. Assn. of Civil Eng'rs of Cornell Univ., 1893. With Salt Water in Winter, *Inland Arch.*, Vol. XI, p. 55. Mortars and Concretes, *Inland Arch.*, Vol. XII, p. 35. Tests of Cement Beams, *Inland Arch.*, Vol. XXVIII, p. 16.

CLAY MATERIAL AS USED IN THE BEST MODERN BUILDINGS.

BY WILLIAM D. GATES.

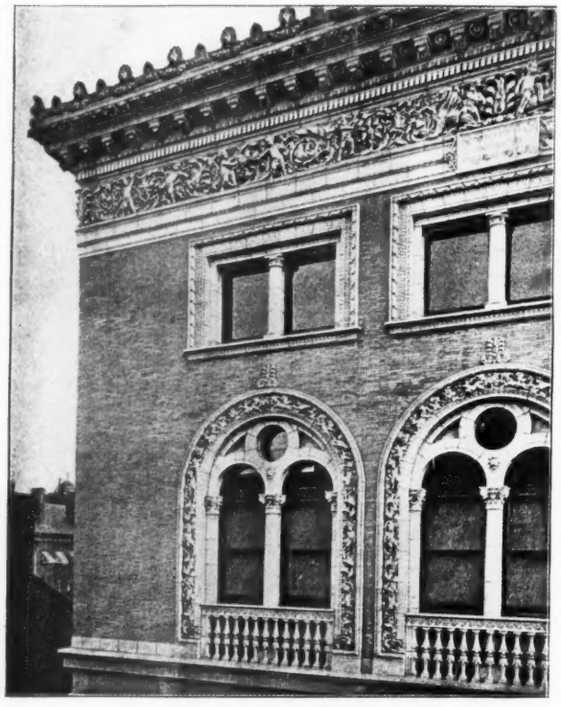
BURNED clay has come into plentiful use in modern building construction and has come to stay. From the very fact of its plentitude, efficiency and adaptability, it has won its place in the art of modern building with a rapidity and scope that have been surprising. This is not to be wondered at when one considers the versatility of the American and the adaptability of the material to the uses. Modern requirements, combined with the trying conditions of a climate in which the tearing-down effects of ceaseless change are constantly at work, demand their use. Torrid heat is quickly succeeded by arctic cold, and rain by sleet, and sleet by snow, and all the trying, prying effects of zero, ice and storms, strain and wear and tear at the structure. Not only must the material withstand these

Executed in Terra-cotta by Northwestern T. C. Co.
Adler & Sullivan, Architects.

forces, but it must protect what is within, must be an insulator of cold and heat, must resist cold and damp, must be strong and lasting, must be pleasant to the eye, must be beautiful in form and color, and must combine with all these many requirements the one great essential of cheapness.

All the cunning of all the earnest workers, in all the scattered brickyards of the country, has been strained and turned toward the betterment of their product in shape, texture, color and cheapened production, until wonderful results have been produced and it would seem that perfection were well nigh at hand. They have done more to bring color within the reach of the architect, for use in the construction of durable exteriors, than almost any one in the material field, bringing in, as

they have, all the solid tints in reds, pinks, buffs, grays and browns, as well as all the wealths of tint in fire flashes and speckles. They have studied their department of the art — for clay working is an art indeed — thoroughly and consistently, with all the zeal that belongs to a devotee (and workers in this art are devotees). They are, in fine, believers in their work. They believe that they have the best material for the work to be accomplished, and they labor earnestly and faithfully to mix into their wares the one very essential ingredient, which must always be mixed with crude clay to make a good product — brains. Having such faith in their material and understanding the field that is to be filled, they stop at no obstacle and brook no hindrance, but struggle through the multitude of trials and disappointments that await them, for trouble is closely connected with clay. Disappointments are many and experimental work is long drawn out. Mixtures must be made and weeks



Terra-cotta trimmings, at Hartford, Connecticut.
Peabody & Stearns, Architects.

afterward results must be studied after the fires have done their work.

Other devotees than Pallisy have burned furniture, in one way or another, and others than he succeed to their reward after surmounting difficulties and hardships. This, not of the brickmaker alone, but of all clayworkers as showing that the finished structure is beautiful and durable, not only through the good qualities of the crude clay, but also by means of the brain and energy of the faithful worker, who wrought something of his life itself into the material and made it possess something of his own individuality. Of course, the architect looks ahead and studies the needs, and schemes out a way to meet these new and very pressing requirements. Land has become very valuable and two or three floors will not do, but the building must extend skyward. This would be well-nigh impossible, following old methods, for the lower stories would be well-nigh solid with masonry and the weight excessive even then. So he plans the use of other wares, and calls on the disciples of Vulcan to build him a bridge on end, to protect and ornament which he summons the clayworker, sees what he already has and counsels him as to what he further requires as to shape, color or other effect. Then, too, he uses the individuality of the builder and brings in effects such as Flemish bond or special shape effects. So that in the end the well-burned

Terra-cotta shaft, one piece, 8 feet long.
Executed by American T. C. Co.

clay shuts out the storm and protects the skeleton of steel that upholds the building, and thus conserves space, beautifies the structure and shelters the occupants as well from the elements. All a man's treasures are confided to its care. His dearest treasures, his family, rest sheltered by it in a quiet, protected home, while his fortune he puts into a protecting vault, held secure from fire and theft by the brickmaker's work.

Time was and that too but recently, when he who wished to use enameled brick must send to far-off countries, and when he who wanted enameled terra-cotta must go without, but now our own manufacturers are proud of the quality, texture and tint of the wares they produce here. Their wares have been speedily utilized by the architect and the builder as being an ideally

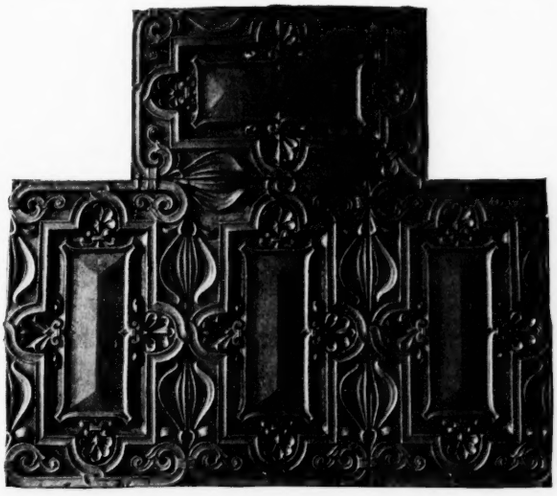
Executed in terra-cotta.

cleanly ware for our dirty cities, as being among the few wares unaffected by the tearing and wearing forces of a great city and as among the extremely few that could be easily cleaned from the city's dirty grime. It has been extensively utilized for the white purity of the bath, the cleanliness of the kitchen, the

light-giving walls of the court, and now and again for the front of some building where the despairing owner desired cleanliness, and even, on occasion, owner and architect have been daring enough to court criticism by using color.

The maker of roofing tile has been active and zealous in his department. He has found new requirements and has risen to them with new shapes, new designs, new color effects and improved weather-resisting bodies and wares.

But into the field of the manufacturers of terra-cotta there come problems unknown and undreamed of by other craftsmen. Others have stock and sort to color, while he is called on to match any and all colors, in pieces in all sorts of shapes for all sorts of individual places, every one of which must match the sample in color and fill its allotted space and mission in the



Executed in terra-cotta. Holabird & Roche, Architects.

building. He must so know his mixtures and shrinkage that he can calculate ahead as to what these will be when they have passed through the heat. He must spend money and energy freely — unstintingly — in thousands upon thousands of experiments, of all of which he must keep accurate account, so that he can duplicate any one accurately, and thereby stand ready at the call of the architect. In this, however, he has the reward of an interesting line of work and a work that keeps him tense and on "concert pitch" all the time, allowing him no time for rest, but constantly urging him on to other triumphs.

Then, too, when his work is done; when the building is complete and the bill paid, he can always glory — with the architect — in the building, and stand straighter and feel bigger when he looks at his own honest ware protecting and beautifying the building.

Other articles are:

Brick Work, *Inland Arch.*, Vol. VII., p. 58. Terra-Cotta, *Inland Arch.*, Vol. VII, p. 97. Repg. T. C., *Inland Arch.*, Vol. XVII, p. 59.

ELECTRICAL ENGINEERING FOR ARCHITECTS.

BY ARTHUR VAUGHAN ABBOTT, C.E.

THE development of the applications of electricity during the past twenty years has produced a new set of problems to be solved by every architect in the construction of such buildings as are placed under his charge. A generation ago, no question arose as to the methods of illumination. A set of gas pipes was introduced, connected to the municipal supply; the various rooms were equipped with chandeliers, and the work was done, giving the architect little or no opportunity either from a mechanical or an esthetic standpoint. The advent of the electric light, however, changed all this, and at present it is essential that every building of magnitude shall be not only supplied with illuminating gas, but, in addition, electricity as an illuminant must be introduced, and in connection therewith all of the electro-mechanical problems necessary to the safe and proper installation of the new agent must be considered.

With the esthetic features the present paper has little to do, and is restricted to a consideration of the proper manner of introducing electricity, the uses to which it may be applied, and the safeguards which should be observed in its installation.

In the early days of electric illumination each building had to be supplied with a separate and independent plant for the generation of the necessary electrical energy. Soon, the idea of central station supply became current, and rapidly the larger cities were equipped with generating plants of magnitude, and the principal streets furnished with distributing mains, so that architects were no longer required to provide isolated plants. The illuminating companies took great pains to inculcate the idea that it was much cheaper to buy electricity than to install and operate an isolated plant, and in the majority of cases this statement has been and is still correct. Yet of late there has been a considerable tendency on the part of larger stores and other buildings to install plants and to supply themselves with electricity under their own management, and therefore the first problem to be solved is to determine whether an isolated plant shall be used or not.

This question is purely an economic one, namely, Will the operation of an isolated plant be cheaper than the purchase of a sufficient amount of electricity from the central station? To reply correctly, it is necessary to approximate the load line of the building; to determine therefrom the maximum demands to which the plant must respond, and the load factor which is likely to be obtained. Both of these points are essential. For the capital necessary to invest in the isolated plants depends on its size, and this is in direct proportion to the maximum demand, while the expense of operation is governed by the average load factor.

To determine the probable load line it is convenient to plot, upon transparent cross-section paper, the estimated amount of electricity required to supply the demands of the building for, say, the months of June, December, April and September. Then, by superimposing the four drawings, the maximum demand can at once be read, and the average load line calculated with a planimeter, from which it is easy to ascertain the load factor. Such a diagram is shown in Fig. 1, taken from a large hotel plant.

For office buildings, an approximate estimate may be made by assuming that about seventy per cent of the connected lamps will be illuminated during December from 4 P.M. to 6 P.M., about fifty per cent will be used from 8 A.M. to 9 A.M., and in addition all of the lamps in covered corridors, toilet rooms and dark inside rooms will burn continuously from 7 A.M. to 7 P.M. After 6 P.M. not over ten per cent of the connected lamps will, on the average, be used for about three hours during the evening. For September and April, about fifty per cent of the connected lamps will be used from 5 P.M. to 6 P.M., while lamps in halls and dark rooms will burn as before, possibly ten per cent will be used for an hour in the morning. For the June diagram, not more than ten per cent of the connected lamps will be used from 6 to 9 P.M. No lamps will be lighted in the morning, and those in halls and dark places reduced one-half. About the same rule may on the average be held to apply to the larger stores that do not remain open in the evenings. For hotels, clubhouses and similar buildings, about eighty per cent of the connected lamps will be expected to burn from 4 to 8:30 P.M. in December, about sixty per cent from 8:30 to 10 P.M., and about forty per cent will be used from 10 to 11 P.M., while about forty per cent must be expected to be in service from 6:30 to 8:30 A.M. In April and September about the same percentages of lamps will be used, but the hours of lighting will not commence before 5 P.M. and will end at 8 A.M. In addition, the necessary lights for halls, corridors, etc., must be included.

The power demands may be calculated in a similar manner. For the ordinary office building, electric elevators and electric

pumps for house water supply are now common pieces of machinery whose use is rapidly extending. For the pumps, a steady load line may be assumed where it is practical to so design the pumping machinery that it may operate at a uniform load from 8 A.M. to 5 P.M. The elevator load will be a maximum between 8 A.M. and 10 A.M., 11 A.M. and 2 P.M., and 4 P.M. and 6 P.M., while for the rest of the time about forty per cent of the elevator capacity should be allowed during the day time and about five per cent during the evening from 7 P.M. to 10 P.M. In summer, from June to October, the load imposed by fan motors may amount to a considerable item, averaging about twenty-five per cent of the connected lamps. In office buildings, excepting in special cases, there is little other demand for power; but in hotels, clubhouses and the like, considerable additional power must be allowed to operate kitchen and laundry machinery.

Having from this or similar data plotted the load line for the plant in question, the maximum demand can at once be read from the diagram, and the average load factor calculated by determining the ratio between average demand for power and the maximum capacity of the plant. The architect is now ready to select the appropriate machinery to meet the demands of the building. For economical operation the plant should run uniformly under such a load as will give the least steam consumption per unit of output, but as the load diagram shows a very wide range in demand it is either necessary to secure a large degree of flexibility, or else to operate uneconomically during the greater portion of the time. There are two methods which may be employed.

First: The necessary capacity may be secured by arranging several generating units of medium size, which may be operated either singly or in parallel, and by starting or stopping one or more of these units, the demands on the plant may be met by the most economical rate of supply.

Second: A generating plant may be designed of such size, that its entire output during a given twenty-four hours shall equal the requirements of the building. Such a plant will deliver too much electricity during the hours of light load and too little during the hours of heavy load; but if it be run in connection with a storage battery, to absorb energy during the hours of light load and to emit this energy during the hours of heavy load, the requirements are provided for. Theoretically this method is ideal, and were storage batteries in practice as successful and economical as they are in theory, there would be but little question as to the advisability of their uniform adoption. Unfortunately, particularly in this country, accumulators have not at present arrived at that degree of perfection which electricians have always hoped and even claimed for them, so it is impossible at present to give a hard and fast rule which shall govern a decision between the multiple unit generating plant *vs.* the storage battery. For each particular case the question may be determined by comparing the cost of operating the multiple unit plant with that of the battery plant, augmented, however, by the interest and depreciation necessary to allow on the capital invested in the battery, which should be taken at not less than eighteen per cent per annum on the cost of the cells.

Having determined the proper size and kind of plant to install, and estimated the cost thereof, it is next advisable to determine the expense of electricity, as made up of the cost of operating the plant plus the interest and depreciation of the capital invested therein.

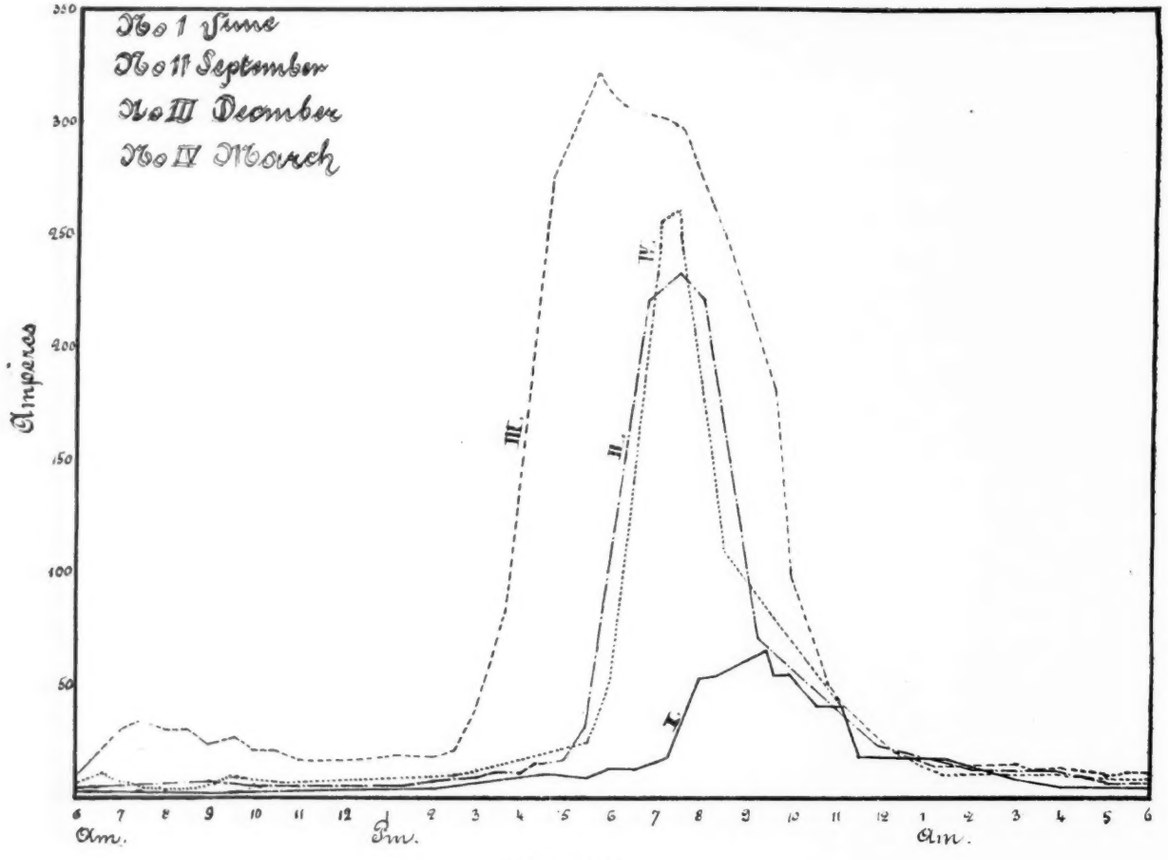


FIG. I.— HOURS.

With ordinary coal at $2 per ton and a well built, carefully managed plant, it should be easy to produce steam at an expense not to exceed 12 cents per 1,000 pounds. With varying prices of coal the expense of steam raising will be closely in direct proportion to the change in fuel prices.

With average engines a steam consumption of from 28 to 32 pounds per horse-power for simple engines or from 20 to 25 pounds per horse-power for compound engines should be allowed. Under average loading the generator efficiency for direct-connected machines will be from eighty-five to ninety per cent; thus this data will enable the designer to determine, for each case, the cost per kilowatt hour of current delivered at the generators, and to compare the same with the selling price of current as delivered by the central station supply, and whichever then shows the most favorable figures is the proper method to advise.

Generally stated, for all ordinary office buildings and stores, it is cheaper and more reliable to depend upon the central station than to install an isolated plant, *provided* the boilers must

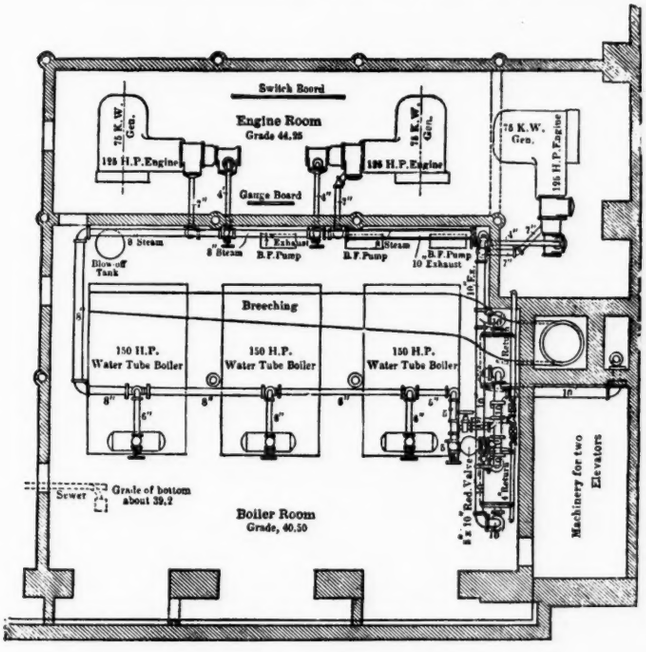


FIG. 2.— PLAN OF BOILER AND ENGINE ROOM.

be continuously used to supply the electric plant only, but it is now usually necessary to supply office buildings with a boiler plant for steam heating, which in ordinary northern altitudes must be operated for at least eight months during the year for this purpose. If, during the average heating season, the steam required for heating is greater than that needed to supply the other machinery in the building, such as elevators, etc., plus the necessary steam required to operate the electric plant, then it is obvious that as steam for heating may first be passed through the engine cylinders without detracting from its heating efficiency, all the building machinery may be supplied with steam during the heating season at no greater cost than is required to warm the building, and should only be charged with fuel expense during such part of the year as steam for warming is not required. Under this condition, an isolated plant may be very profitable and the designer need pay little attention to steam economy, for as more steam is required for heating than is sufficient to operate the various steam cylinders, compound or condensing engines and back pressure upon the pistons are matters of but little importance.

In very general terms the prices charged by central stations for electricity for lighting vary from .8 cents to 2 cents per 16 candle-power lamp hour. For power the rates vary from 5 to 10 cents per kilowatt hour, depending upon the quantity used. The cost of producing electricity by isolated plants, including interest, depreciation and insurance, with coal at $2.50 per ton and labor at $3 a day, will vary from 6 cents per kilowatt hour, with

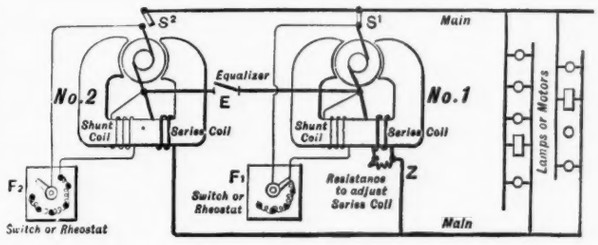


FIG. 4.— COMPOUND-WOUND DYNAMOS IN PARALLEL.

an output of say 50,000 kilowatt hours per annum, to 3 cents per kilowatt hour for an output of 500,000 kilowatt hours per annum.

GENERATING PLANT.— Assuming that the comparison between the cost of producing electricity by an isolated plant and that of a supply from the central station indicates the advisability of an independent installation, the designer must provide the best and most economical machinery for the purpose. A general design for such a plant is given in Fig. 2. It is convenient, therefore, to divide the plant into four parts: THE STEAM PLANT, THE ENGINES, THE GENERATORS AND THE SWITCHBOARD. All this machinery is now so completely elaborated by first-class manufacturers that it is unnecessary for the designer to prepare anything more than a general specification and to award the contract to the lowest responsible bidder among the well known builders of the various classes required.

BOILER PLANT.— Where steam pressure of sufficient magnitude to operate modern engines is required, it is inexpedient to consider anything but one of the best-known forms of water-tube boiler. Though this type is more expensive in initial cost, its greater safety, decreased cost of maintenance, facility of repairs and ease of installation, make its selection advisable where steam pressure of 80 pounds or more is to be carried. In plants requiring 300 horse-power or over, it is desirable to provide one of the standard forms of automatic stokers, as it is uneconomical to require one fireman to attend to and handle coal for a larger boiler capacity, and wherever the saving of a man's labor can be made mechanical appliances will invariably show a profit.

Careful attention should also be paid to securing the best

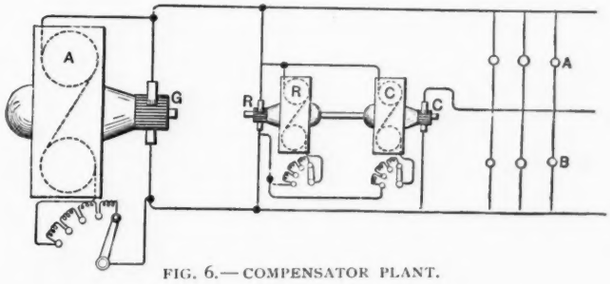


FIG. 6.— COMPENSATOR PLANT.

facilities or handling coal and ashes. Storage for at least sufficient fuel for a week's run should be provided, to guard against strikes, snow blockades and other contingencies, which, if the reserve were small, might necessitate a shut-down of the plant. If possible, the coal and ash bins should be so located, with reference to the boilers, that the fuel may run by gravity to the stokers, and when the ash pits are cleaned the

refuse should pass by its own weight to the ash bins, thus allowing the fireman to give all his attention to the boilers by relieving him as far as practicable from manual work. Where the arrangement of the building is such as to render this plan impracticable, a light railway or overhead telegraph with automatic buckets is the best substitute. Proper scales should be provided, in order that all coal and ashes may be weighed, for in no other way is it practicable to keep a check upon the performance of the boiler plant.

By placing a pump upon the end of the heating system the radiators, at least during the winter season, may serve as an air condenser, and the steam consumption of the engines thereby somewhat reduced. The discharge of this pump should feed the boilers through a heater, even if live steam be used for the purpose, for although apparently paradoxical, it is cheaper to use live steam to heat the feed-water rather than to feed it cold to a hot boiler. All the boiler feeds should also be carefully metered and checked against the coal consumption.

ENGINE PLANT. — The engines and generators should always be direct-connected machines, as belt-driven apparatus is a relic of a barbaric electrical past. It is also desirable to secure as heavy and stocky an engine as can be procured, even at some additional cost, for with the unexpected loads to which an electric light plant is frequently subjected, cast iron is very much cheaper than a break-down, and generous and ample proportions in the bed plates and frames is good engineering. The reader will at once debate the advisability of multiple expansion engines over those of the ordinary simple type. It has already been shown that an isolated plant, operated solely for the production of electricity, can rarely pay in competition with the central station supply, and that such plants are usually profitable only in connection with some other demand for steam. If, therefore, heating buildings or other requirements necessitate a steam supply for a greater portion of the year, the advantage both of the compound and condensing engine largely disappears and it is of little or no consequence to incur additional expense in the plant, solely for the purpose of steam economy. Indeed, from some points of view, there may be a distinct disadvantage in the multiple expansion engine, for, though less steam per horse-power is consumed, the increased

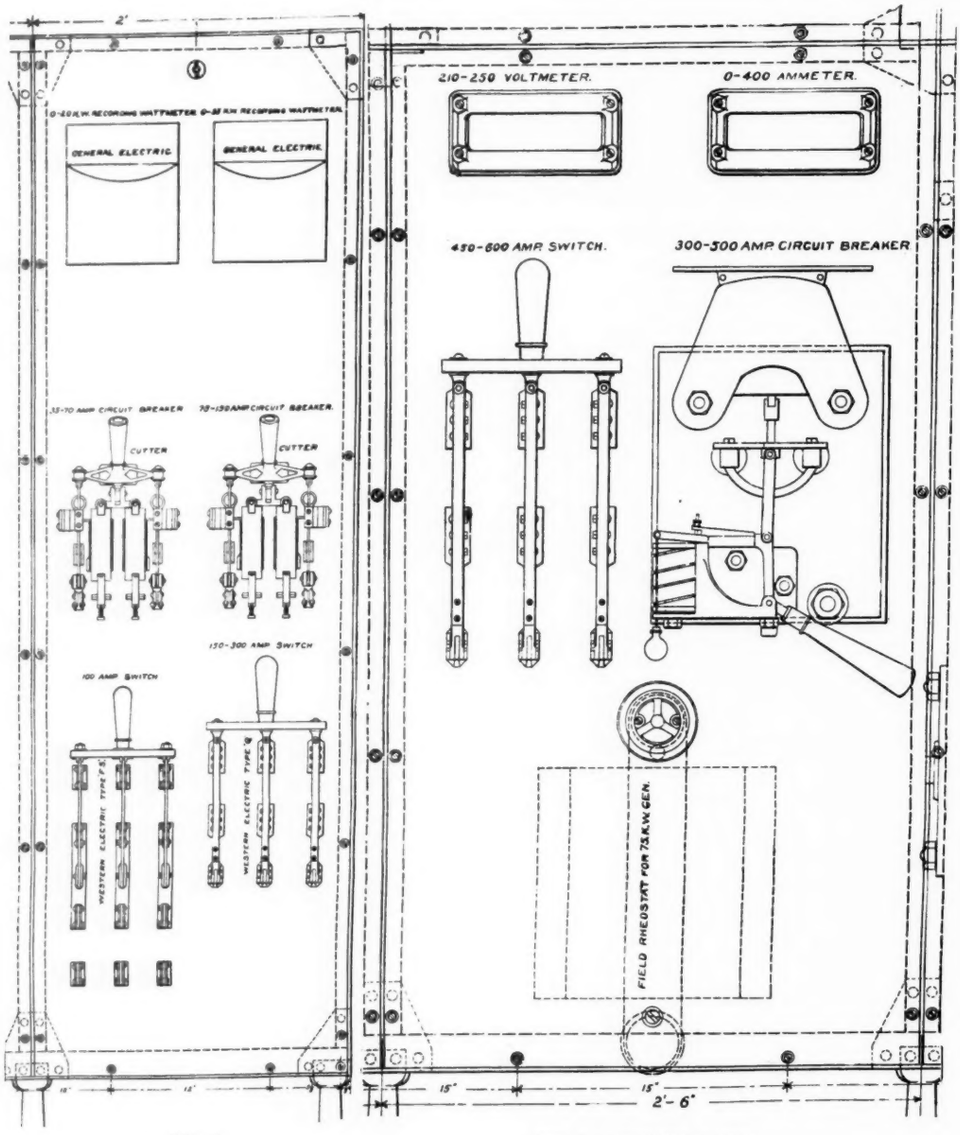


FIG. 5.

FIG. 3.— DYNAMO PANEL.

initial expense, greater complexity and augmented cost of maintenance far outweighs any such saving, particularly when live steam must be added to the exhaust to supply the heating system. The same reasons apply to the use of a condenser. During the portion of the year when steam is not needed for heating the building, a condenser, provided cheap water is plenty, may be advantageously operated, but during the heating season it is more advantageous to exhaust directly into the heating mains and to omit entirely the use of a condenser. Under no circumstances apply a condenser where city water is to be used for the purpose, for the price charged for the municipal water supply is very greatly in excess of the saving by the use of a condenser, and even artesian well water is false economy when it has to be pumped more than about two hundred feet.

GENERATORS.— A short time ago it was essential for the designer to draw complete specifications for the generators, and he had to be so much of an electrical engineer as to be able to thoroughly describe all parts of a dynamo, and assure himself that the machine was properly constructed in accordance with his specifications. At present, the half-dozen large dynamo builders in this country have so thoroughly systematized and formulated their apparatus that it is now unnecessary to do more than to decide on the size of the machine, the voltage at which it shall operate, the number of amperes to be delivered with a specified rise in temperature of both armature and field coils, and the method whereby the generator shall be connected to the engine. There is, doubtless, a tendency on the part of generator manufacturers to overrate their machinery, particularly as to the heating limits. It is, therefore, necessary to strictly qualify that neither the armature nor the field coils shall, on continuous running, rise over 80° Fahr. above the temperature of the surrounding room. This limit may seem a low one, but when it is recollected that, in summer, the temperature of engine rooms may occasionally rise above 100° Fahr., it will be seen that this heating limit allows the windings of the generator to rise nearly to the temperature of boiling water, beyond which it is not safe to allow electrical apparatus to go.

To be sure that this specification has been fulfilled it is customary to operate the generators for, say, twenty-four hours continuously on their maximum load, and then to measure the temperature of the windings by determining the increase in the resistance which has occurred between the machine hot and the machine cold, the resistance of the windings having previously been ascertained before the apparatus has been started on its test run. It is also customary to require that the machines shall run sparkless between no load and full load without any change whatsoever in the position of the brushes. Frequently it is also desirable to specify that the field windings shall slightly over-compound the machine sufficiently to make up for a small fall of potential in the building leads, so that under full loads all the lamps may burn fully up to candle-power.

Finally, the most important consideration is the subdivision of the plant into the proper units. It is always essential to provide some reserve machinery, for the very best regulated of human contrivances are sometimes incapacitated. It is always profitable to so arrange the plant that it may during the greater part of the time work at its most economical rating. Experience has shown that, on the whole, four units for the engine and generator plant make the most economical arrangement. These units should be so proportioned that three will be sufficient to carry the maximum load, leaving one constantly in reserve, ready to step in in case of the failure of any of the others. The units should be so proportioned that one unit will be operating at its most economical rating during the period of lightest load, two units should be sufficient for the average load, and three be capable of taking care of the maximum demand. By this means a skilful isolated plant engineer can constantly keep his machinery working at its most economical point.

For the boiler plant it is not so essential to subdivide into as many units. It is, however, advisable to have one boiler constantly in reserve, reserving two boilers for regular service, one of which may be run at average capacity during hours of light and average load, while the second one is put into service during the hours of maximum load.

SWITCHBOARD.— The switchboard is the clearing house of the electrical plant. All of the energy generated is delivered

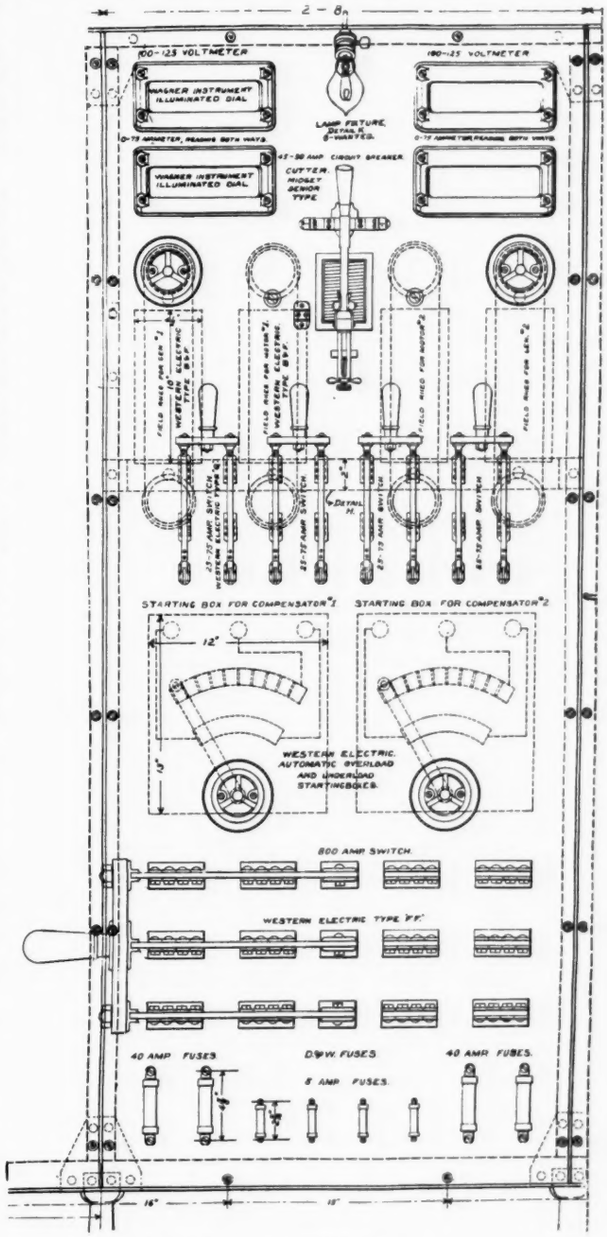


FIG. 7.— COMPENSATOR PANEL.

to the switchboard, and from it is distributed as may be required, and from the readings of its instruments a balance sheet of the performance of the plant may be obtained. The switchboard is also equipped with the indicating mechanism from which the operation of the dynamos is estimated, and furnishes the necessary information to guide the attendant in the manipulation of the machinery. Though the component pieces of apparatus are now well standardized, there is abundant opportunity for the designer to display electrical, mechanical and artistic skill in its arrangement, as probably no two

boards would be built just alike. It is desirable to divide the board into two general parts: First, a series of panels to which the dynamos are directly connected and which carry all of the apparatus for controlling and governing them, for indicating their performance and for providing for their safety; second, a series of panels equipped with the necessary distributing apparatus, whereby the energy delivered by the generators may be guided to the distributing system in any desired manner, the necessary instruments for recording and determining what becomes of the electricity, and such protective devices as may be required to guard the circuits. As each panel is similar to all the others of its kind, a specification and drawing of a typical one of each is all that is essential to the construction of the most elaborate switchboard, for it is simply necessary to multiply the respective panels as many times as there are dynamos or distributing mains.

In general the board consists of an appropriate iron frame, built of angles or tees containing a sufficient number of spaces

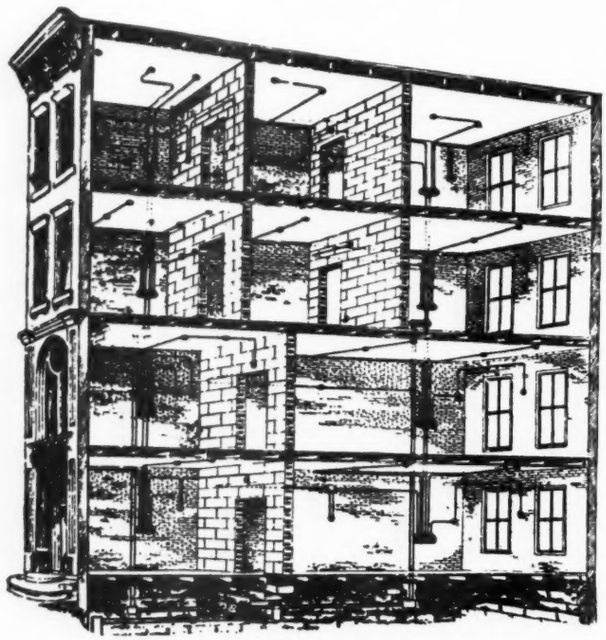


FIG. 8.

to provide room for the requisite panels. These spaces are properly filled with marble or slate, for the designer's choice is limited to these two materials, as nothing else at the present time has been found adequate for the purpose. The generator panel is shown in Fig. 3 and should consist of an appropriate marble slab, upon which is mounted a double pole, single-throw main switch for closing the main circuit from the dynamo. Immediately beyond the main switch should be placed a circuit-breaker, adjusted to the size of the generator. Automatic circuit-breakers are much more desirable in every respect than fuses. They work upon a narrower margin with great accuracy, and may be replaced in case of short circuit much more promptly than it is possible to introduce a fuse. Beyond the circuit-breaker a wattmeter should be placed, to indicate the output of the generator, and in addition the panel should be supplied with a voltmeter and ammeter for giving instantaneous readings. It is almost impossible to obtain a good, permanent switch in which the hinge forms a portion of the circuit; the T. H. wattmeter is probably the best known American instrument for this purpose, while the ammeter and voltmeter should be of the Western or Wagner type. The generator panel should also be equipped with the necessary adjusting rheostat, inserted into the field circuit, whereby the voltage of the machine may be controlled within reasonable limits, and each machine adjusted to run in parallel with the other generators. An equalizing bus bar and switch is also desirable. Fig. 4 contains a diagram of the circuits for this purpose. Beyond the generator panel the machine circuits are extended and secured to the main bus bars which extend along the entire length of the switchboard, receiving the current from all the generators and delivering the same to the various distributing panels.

Each distributing panel (illustrated in Fig. 5, showing a panel with circuits for two floors) should consist of an appropriate switch, one set of points of which is connected to the bus bars, while the other set is attached to one set of distributing mains. Between the switch and the bus bars a wattmeter should be inserted for measuring the amount of electricity to the set of mains in question. An automatic circuit-breaker should also be provided to guard against short circuits. The distributing panel, therefore, is quite a simple piece of apparatus. All parts of the switchboard apparatus should be constructed in the very best possible manner and ample proportions allowed in the connections, switches and wiring, so that there may not be an undesirable fall of potential and loss of energy through the board.

It is customary to specify that, from the dynamo connections to the distributing circuits, there shall not be a drop of more than one-fourth to three-fourths of a volt under full load. The board should be safely and securely mounted, so designed that all instruments may be convenient to the hands of the operator, and set a sufficient distance from any wall or partition so as to give easy access to all parts.

WIRING SYSTEM.— The reader will probably wonder why no allusion has been made to different systems of wiring. Where an isolated plant is used, this question is of but little importance. A high-tension alternating system would not receive a moment's consideration, and, except in the very largest buildings, the saving in cost of copper by the employment of the well-known three-wire system is so small that it is often outweighed by the increased expense necessitated by more complicated machinery. This is particularly true, since our English cousins have set us the example of the use of 220-volt lamps of low cost and high efficiency. Theoretically, if both sides of a three-wire system be kept in accurate balance, the expense of copper in the conducting system may be reduced to three-eighths of that which it would be were two-wire mains employed. Practically only a half or one-fourth of the copper can usually be saved in building-wiring, and this economy is largely offset by an increase in the cost of installation and more expensive fixtures.

In the case of large buildings, a three-wire system may for its own sake be desirable, and if, as is frequently done, the central station be used as a reserve in case of accident to the isolated plant, a three-wire system must be installed, but then considerable complication is required in the machinery of the isolated plant. All attempts to operate one generator with three brushes have proven failures, so that, if this method of wiring is used, it is essential to make each unit of the generating plant to consist of two dynamos — a most undesirable and expensive complication — or else to use the more modern method involving the introduction of a compensator. This device consists of two small dynamos having their armatures rigidly connected upon the same shaft. The large generators have their brushes attached to the outside mains, while the compensator is so connected between each outside main and the neutral wire that if the system becomes unbalanced on either side the compensator becomes an auxiliary generator and supplies the deficiency upon the side which demands it. The arrangement of main generator and compensator is given in Fig. 6. As the compensators are quite small, usually only one-tenth or one-fourth of the size of the large generators, their installation is relatively inexpensive, but, to avoid an accident, the compensator system must be in duplicate, and proper

panels carrying the switches, starting and regulating rheostats, circuit-breakers, voltmeters and ammeters, must be provided on the switchboard, as shown in Fig. 7.

MAIN CUT-OUT.— If the calculations for economy show that the central station supply is preferable, the high-pressure boilers disappear and are replaced by cheap cylindric heating boilers. The engines, generators and switchboard vanish, while the lighting company extend their mains through the cellar wall and electricity is on tap. Here, however, the designer must provide *a building center;* in other words, a very much simplified switchboard, which usually consists merely of a main switch to provide a means of opening the central station circuit, together with the necessary circuit-breaker or fuses. It is also desirable to install a wattmeter in order to check the total building consumption. Should the central station supply be a high-tension alternating current, a step-down transformer is employed at this point, and the whole apparatus must be set in a fireproof vault outside of the building.

WIRING.— All the work on the building side of either the switchboard or building center is exactly the same, whether an isolated plant or central station supply be employed. For small and medium sized buildings, a set of mains should be extended vertically from cellar to attic as near as practicable in the center of the building, and conducted to the building center or switchboard. At each floor a cut-out box is introduced into the mains, from which the circuits for the individual rooms branch from proper cut-outs and fuses. It is well to provide at this point for the meters, unless it be desirable to install a meter in each room, which is sometimes the case where many small tenants are involved.

For larger buildings it is preferable to extend a set of mains to each floor, as is indicated in a sectional view in Fig. 8, thus rendering the various parts of the building entirely independent of each other, so that a short-circuit at any point only involves the portion of the building in which the trouble is located. Each set of floor mains then should extend to the switchboard or building center, and there be protected by proper fuses and switches. At each floor, also, a proper cut-out box should be installed, from which the circuits to the individual rooms branch in the manner already described.

No method of wiring excepting that of employing interior conduit should be considered, as molding work for first-class buildings belongs to an obsolete electrical past.

The general specifications for conduit work and wiring installation are so completely covered in the National Electric Code that it is superfluous to repeat them here.

Other articles:

Electric Power for Isolated Factories, *Eng. Mag.*, Feb., 1895. The Niagara Falls Plant, *Elec. World*, Feb. 9, 1895. Power Transmission, *Elec. World*, Nov. 10, 1894, *et seq.* Elect. Lighting System, *Elec. Eng.*, April 10, 1895. Electric Wires, *Inland Arch.*, Vol. XIV, p. 72.

MODERN METHODS OF HEATING AND VENTILATING BUILDINGS AS PRACTICED IN THE UNITED STATES.

BY JAMES J. LAWLER.

WHILE there is a possibility in the course of a few years for electricity to take a high place as a medium for the warming and ventilating of buildings in general, it is as yet in its experimental stages, as well as being entirely too costly for general use from a commercial point of view, and will, therefore, receive no further consideration in this article.

There are, practically speaking, but two general mediums for the warming and ventilating of any class of building through which great perfection can be attained from any point of view, and these are steam and hot water. In the utilization of steam as a heating medium, there are many methods employed in construction of the heating plants, and this is due to both circumstances and conditions. We have, therefore, systems which are specially adapted to certain classes of buildings, and which possess great advantages for such special work.

There being no universal standard method of construction for the various classes of buildings, each heating engineer or architect, as a rule, arranges the heating plants to his own notion, and the result is that hardly two heating plants, even in the same class of building, can be found constructed in the same manner, and this proves that there is still a large amount of experimenting constantly going on in the steam-heating field.

STEAM BOILERS AND THEIR CONSTRUCTION FOR HEATING PLANTS.

In constructing a boiler for a steam-heating plant, there are two specially important points to be taken into consideration, the first being that of safety, and the second important point is economy in the consumption of fuel. In making such selection the general method employed in the plant to be installed will have much to do with this decision, but the pressure of steam to be carried on the boiler should have the most weight in deciding on the type of boiler to be used.

If the boiler is to be used solely for the purpose of warming the building on what is known as the low-pressure gravity-return system, which means that five pounds pressure of steam per square inch will be the limit carried, almost any type of boiler may be used with safety, provided that such boiler is equipped with a reliable safety valve of proper size. This low pressure of steam will not answer for power purposes, and, therefore, such systems are limited in their utility, because there are so many buildings that require steam from the boiler for power purposes, as well as for the heating of the buildings.

There are two general types of steam boilers used for steam-heating plants and power combined; one is the ordinary horizontal tubular style, and the other is the water-tube or pipe system of boiler construction, and there is a great difference between these two types of boiler from the standpoint of safety against explosions, in favor of the latter. To explain the reason why the ordinary shell boiler is more dangerous under high pressure of steam than that of the water-tube type,

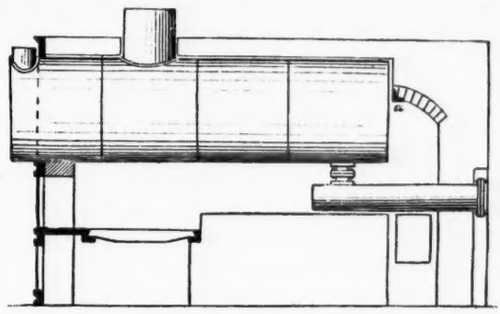


FIG. 1.— THE FIRE-TUBE TYPE OF BOILER.

we make use of the illustrations, Fig. 1 and Fig. 2. In the horizontal tubular boiler, a single shell holds all the water and steam, as shown in Fig. 1, and through which the fire tubes pass, and in order to secure large fire surface, the shell or body of boiler must necessarily be large, and this means a greater quantity of water to be carried in the boiler. One of the reasons why the increased diameter of a shell or tubular boiler decreases its resisting power against internal pressures is because the thickness of the metal is not as a rule increased in proportion.

The illustration, Fig. 2, will answer to show the general construction of the water-tube or sectional-tube boiler, which consists principally of pipe from two to three inches in diameter, and usually placed in an inclined position, as shown in illustration. To increase the capacity of the water-tube boiler, it will be simply necessary to add additional sections of tubes having the same diameter; hence this in no way weakens the boiler;

AT COLUMBIA COLLEGE.
McKim, Mead & White, Architects.

AT UNIVERSITY OF PENN.
Cope & Stewardson, Frank Miles Day & Brother, Wilson Eyre, Associate Architects.

AT CHICAGO UNIVERSITY.
Henry Ives Cobb, Architect.

AT YALE COLLEGE.
Charles C. Haight, Architect.

A GROUP OF NOTEWORTHY EDUCATIONAL BUILDINGS.

neither does it add as great an increase of water for the additional surface as that which would be necessary in the shell type of boiler. It will, therefore, be seen that the water-tube boiler will stand the greatest pressure of steam.

When boilers explode it is always due to high pressure, and that which is the cause of the greatest damage on such occasions is the water contained in the boiler at such times. If we consider for a moment the space occupied in the boiler by the steam, and that which is taken up by the water, and at the same time remember the specific heat of both, we will clearly understand why the water can be the cause of the greatest destruction in the case of an explosion. Water in a steam boiler under steam pressure carries the same temperature as that of the steam, and boilers used for high-speed engines which operate electric-light plants as well as to furnish heat for the buildings, carry from 80 to 110 pounds pressure of steam

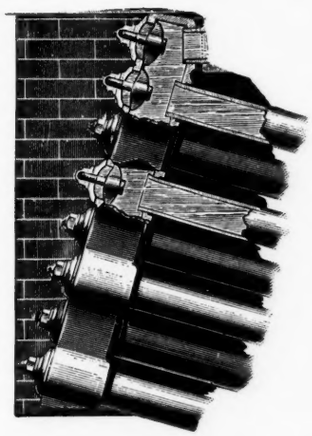


FIG. 2.—WATER-TUBE TYPE OF BOILER.

per square inch, and this means that the water in such boilers will have a temperature of from 323 to 344 degrees, and its expanding force will be 1,600 times greater than that of the steam when liberated from the boiler, as would take place in the event of an explosion.

Experience has taught us that the many mysterious boiler explosions can be traced to a want of sufficient strength to withstand the pressure. This lack of strength may be inherent in the original construction of the boiler, but is most frequently the effect of the weakening of the iron by strains due to unequal expansion caused by unequal heating of different portions of the boiler; or it may be due to corrosion from long use. If steam boilers are properly proportioned and constructed, they will, when new, be safe against considerably more pressure than the safety valve is set to; and the hydrostatic test, properly applied, may discover faults in material, or the weakening effects of corrosion; but against the danger resulting from unequal expansion, ordinary boilers such as the horizontal type have no protection. In getting up steam many boilers will be very hot in some parts, while other parts will be cold, and under these conditions enormous strains must occur in some parts of the boiler, which parts are thereby weakened, and these strains being frequently repeated, will eventually so far destroy the strength of the line or point of greatest strain that rupture must result. Generally the rupture is small and gradual, but sometimes large and productive of disastrous explosions. Want of local circulation of water in boilers is a frequent prolific cause of unequal expansion.

Another source of great danger in the shell type of boiler is low water, and constant vigilance is required to keep the water at a proper height. In many boilers the fall of only a few inches in the water line will cause the crown sheet or some other portion to be exposed to the direct action of the fire, whence it becomes quickly overheated and weakened to such an extent that an explosion is likely to occur. Another frequent cause of unequal expansions and also of weakening by burning and blistering the iron is the presence of deposit or scale on the heating surface. This is liable to occur in any boiler, but in very many there is no adequate provision for removing it when formed, and this is particularly the case with tubular and "locomotive" boilers.

HOW TO PROVIDE AGAINST EXPLOSIONS.

Very much thought and experiment have been expended on this problem, but though many forms of boilers have been produced, which have attained practical safety from explosion, yet in many of them there have been ignored certain elements necessary at the same time to make them valuable as generators of steam for practical work. Hence the very name of safety boiler has become to some persons evidence of undesirability. But safety is not incompatible with other essentials of a perfect steam generator, and may be secured without detracting from any other feature.

The first element of safety is ample strength. And this can be best attained in connection with heating surface by small diameters of parts, and it will therefore be seen that where high pressure of steam is to be generated, the sectional water-tube boiler of proper construction stands in the front rank from the point of safety against explosions.

A SPECIAL ADVANTAGE IN THE SECTIONAL BOILER

lies in the fact that it can be placed in any building without having to provide special openings in walls, which are necessary in most buildings to admit the shell or horizontal tubular type of boiler.

HOT-WATER GENERATORS FOR HEATING PLANTS AND DOMESTIC WATER SUPPLY.

As the general practice of hot-water heating in this country is that of the open-tank or low-pressure system, which will have simply a hydrostatic pressure due to its water's highest level, and which is open to the atmosphere, and on this account can not carry a temperature higher than the boiling point — 212° — there need be little fear from explosions even though any type of boiler or heater is used. Yet experience has taught us that special requirements are necessary in the construction of these boilers for this special purpose in order to obtain the best results, and we therefore find a wide difference in the efficiency of hot-water generators from every point of view.

Cast iron is used in the construction of hot-water heaters at the present time to a much greater extent than any other material, and while cast iron will have sufficient strength to resist the necessary pressure when constructed on good principles, as well as possessing a quality which better resists the corrosive action of hot water than wrought iron, there are other reasons for the more general use of cast iron for such purposes. While there is to be found in this country a large number of thoroughly experienced and reliable manufacturers of cast-iron heaters whose advice and goods can be relied upon, there is also to be found a much larger number of individuals who are flooding the market with things called boilers that are mere snares and deceptions without any qualification in their favor except price, and this is placed on the basis of scrap iron. It is therefore not to be wondered at when we find great differences in estimates submitted for the installation of steam and hot-water heating plants.

DIRECT RADIATORS FOR STEAM AND HOT-WATER HEATING PLANTS.

As a matter of fact, there is nothing connected with the heating of buildings in which greater improvements have been made during the last few years than in the efficiency and design of direct radiators. It is but a very short time since we had to be contented with ungainly heaps of cast iron, or what was still more of an eyesore — pipe coils, scattered throughout the

house, which would remind one more of a factory or a machine shop than anything else. But these clumsy devices of former years have been superseded by radiators, whose gracefulness of outline, delicacy of design, and artistic beauty are in harmony with the requirements of modern architecture.

To such perfection have they brought the direct-steam and hot-water radiation that any style of architecture can be matched in the most elaborately finished rooms of any class of home or building by glancing through the showrooms of up-to-date radiator houses.

Not only can we find handsome and satisfactory designs, but more convenient shapes and sizes to meet practically any situation without departing from the heating efficiency of the same.

SPEAKING OF DIRECT RADIATORS,

when we are making a selection of such parts of the heating plant of our modern home, there are two very important points which we should carefully consider. One is the efficiency of the radiators for properly warming the space intended to be warmed by such, and the other is the finish and style of the radiator.

It must be remembered that radiators are specially designed for locations of plain finish, and where finish or style is not necessary, and there are also specially designed radiators for the parlor, so that it is a simple matter of making the proper selection to get what we want in this line.

A few years ago the writer was invited to submit a proposition to warm a building with steam, and, after looking the place over, asked what style of radiator was wanted (which meant direct or indirect radiation); the owner of the building, not understanding the question, replied, "It is not style we want, but heat." These kind of people, too, have gone, and the heating engineer of today must give both style and heat.

PRACTICALLY NO WASTE WITH THE BEST HEATING METHODS.

As late as a quarter of a century ago there was very little knowledge of or attention given to the important subject of heating and ventilating of buildings. But today it is recognized as one of the most highly scientific and important professions, and while there are many things yet to be discovered regarding this important problem, with the improvements already accomplished as used in the most modern heating plants, there will be little more to be desired.

The main object sought for by the heating engineer is to have a pure atmosphere at a healthy and agreeable temperature at all times in the various apartments of the building to be warmed; and to accomplish this it will be an utter impossibility without the use of some reliable system of AUTOMATIC REGULATION.

Another special object desired, not only by the heating engineer, but by those who must pay for the necessary fuel, is the economy in the consumption of fuel, and, to accomplish this, there is nothing known better than a proper system of automatic regulation, as well as the proper insulation of all steam and hot-water pipes, and heat channels located in places not intended to receive heat from such sources. It is astonishing the amount of fuel that is wasted in large steam or hot-water heating plants where no system of automatic regulation or insulation of the pipes is found. There is no better investment from buildings, where steam and hot water is to be carried any great distance, from a money point of view, than that which can be saved by the proper installation of such pipes with good, nonconducting coverings, not to speak of the protection which such insulation gives to the woodwork and other important structural materials.

It must be remembered that in steam and hot-water heating plants there is an enormous amount of heat lost in transit to and from the points of delivery, and in large plants this often amounts to many horse-power which must be provided for in the capacity of boilers for such heating plants, providing the pipes are not to be covered, and eighty-five per cent of this loss can be saved by using a good quality of NONCONDUCTING COVERING on all pipes not intended as heating surface; and it will also be seen that where pipes are to be covered there will be a large saving in the first cost of boilers, which will often equal the cost of the pipe covering for such heating plant.

AUTOMATIC HEAT REGULATORS, TEMPERATURE CONTROLLERS, AND FEED-WATER HEATERS.

For the more economic utilization of steam or fuel, the three special systems or appliances mentioned above take most important parts. I have stated in another part of this article that one of the best investments from a money point of view in connection with any heating plant is a good system of automatic regulation, and there can be no question about such a system being a most important feature from a hygienic point of view.

There are so many conditions to contend with in the warming and ventilating of buildings, that to secure anything like a uniform temperature of apartments to be warmed without some system of automatic regulation is utterly impossible. Where temperatures are not controlled by special mechanical means there will surely be a loss of heat, and this means waste of fuel.

The stationary steam engine would be an unsatisfactory as well as a wasteful piece of mechanism without its governor to control the supply of steam according to the load to be carried, and this is just what a heating plant is without a good system of automatic heat regulation. The conditions with which we must contend in endeavoring to properly warm a building are constantly changing, and this is one of the reasons why it is impossible to secure either the desired quantity or quality of heat for any given time by human attention.

TEMPERATURE CONTROLLERS.

In large apartment houses, as well as in hotels and other institutions where large quantities of hot water are necessary for culinary and bath purposes, steam is found to be the most simple means of warming such water, and it is also the most economical in consumption of fuel, as exhaust steam from engines is utilized for this purpose as well as live steam. But such hot-water heating systems should in all cases be equipped with thermostatic temperature controllers, which can be set to carry the water at the desired temperature for purposes mentioned above, no matter what the pressure of steam supply may be, so that in this case the temperature controller would not only cause the water to be delivered at the desired temperature, but would protect the apparatus against heavy strains due to unnecessarily high temperatures, and prevent any waste of steam.

Another source of revenue in connection with steam-power plants, which is now universally used in best constructions, is the

FEED-WATER HEATER.

There is no better coal or fuel saving device, where steam is used for power purposes, than the feed-water heater; for the reason that while exhaust steam from engines may be utilized for the warming of buildings in cold weather, it will not be necessary for such purposes in summer, but the feed-water heater can utilize the exhaust steam to advantage in summer as well as in winter. To show in a brief way the great economy in a good construction of feed-water heater, we will consider what is accomplished by such a device. As already stated, water in steam boilers under pressure of steam has the same temperature as the steam therein, so that it is necessary to raise the temperature of all water which enters the boiler to that of the steam carried, and, as also stated, high-speed engines are usually run with a steam pressure of 80 to 100 pounds per square inch, which is equal to 324° Fahr. Exhaust steam in passing from the engine to the feed-water heater will usually be found to have a pressure of about three pounds per square inch; this pressure of exhaust steam also means a temperature

of about 221° Fahr., which is transmitted to the feed-water before entering the boiler. It will therefore be seen that there will be but 103 degrees to be added to the temperature of this heated water after entering the boiler to generate steam at 80 pounds pressure per square inch, and allowing that the cold water before entering the feed-water heater had a temperature of 35° Fahr., there will be found to the credit of the feed-water heater 186 degrees of heat out of the required 324 degrees, or nearly two-thirds saving in the total consumption of fuel.

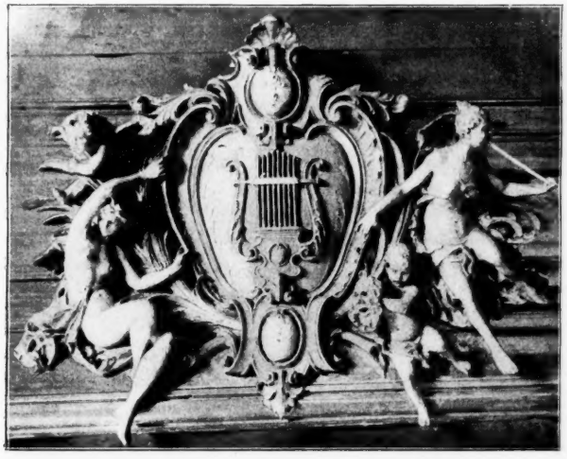
For further investigation, see

Feed-Water Heaters, *St. Ry. Jour.*, April, 1895. Heating a Hotel by Steam, *Eng. Rec.*, Dec. 2, 1893. In a Hospital, *Eng. Rec.*, April 28, 1894. School Building, *Eng. Rec.*, May 12, 1894. Heating Plant Tested, *Eng. Rec.*, June 28, 1894. Proportioning of Ducts, *Eng. Rec.*, Feb. 16, 1895. Comparison of Hot Water and Steam Systems in Municipal Buildings, *Jour. Assn. Eng. Socs.*, 1895, Vol. XV, No. 4. In Tall Buildings, *Eng. Mag.*, Vol. IX, No. 3. The Blower System, *Tech. Quart.*, July, 1893. In Pub. Bldgs., *Inland Arch.*, Vol. VII, p. 26; Vol. VIII, p. 60. H. and V., by Willett, *Inland Arch.*, Vol. XXI, pp. 35, 47, 60, 73. Mechanical, *Inland Arch.*, Vol. XXIII, p. 50; Vol. XXIV, pp. 2, 13, 23, 43, 54.

ARCHITECTURAL SCULPTURE.

BY MAX MAUCH, SCULPTOR.

ARCHITECTURAL sculpture was one of the first efforts in the direction of art. The aim from the beginning has been to bestow upon a building charm and variety by means of harmonious lines and forms. This art is also applied



THEATER DECORATION.
Beil & Mauch, Sculptors.

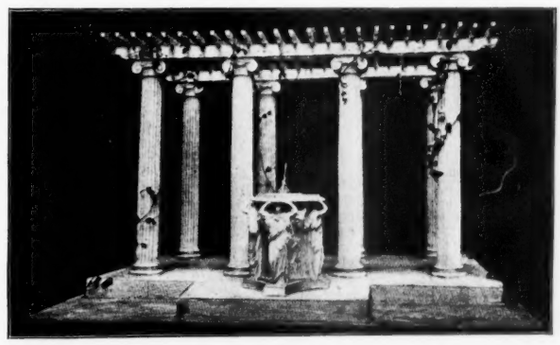
to explain the purpose of a building or to hide a defect in the construction. For the architect this art is of the same value as style is for the author; that is the means to connect gracefully one idea with the other, hence the use of the word "style" in architecture. Therefore, in earlier times, where specialists in this branch were not known, the architect was his own sculptor; later on he associated with a sculptor to carry out the architectural and plastic forms in such a way that one necessitated the other. The technical progress of our present day, by means of which it is possible to complete buildings in one-tenth of the time required formerly, interrupted to some extent this harmonious collaboration. In the last hundred years architectural sculpture has been lowered to an applied decoration which could be left out without injuring the general appearance of a building. Only the latest productions in architecture promise a regeneration of the art in architectural sculpture.

The different branches of this art are divided, according to the various building material used, into stone-carving, terra-cotta modeling, bronze and iron casts, wood-carving, stucco and ornamental plastering, etc. Until a short time ago it was understood that an ornamental sculptor was apt to work in all these materials. Lately, specialists of these different branches have developed, not to the advantage of architecture, and it is to be hoped that this mistake will soon be corrected by the higher aims of an advanced architecture. The most prominent

STUDY BY HENRY LINDER, SCULPTOR.

architects of this country have actually fostered this view by employing sculptors for all the models required for one building, contrary to the custom of allowing the manufacturers to employ their own modelers. In doing so they greatly improved the architectural sculpture.

Referring to the different classes of buildings where architectural sculpture is employed, we may first mention government and public buildings. Although neither time nor money is spared in the construction of capitols, courthouses and post-office buildings, and a great display of sculpture is shown in the same, nothing notable, but rather inartistic and clumsy



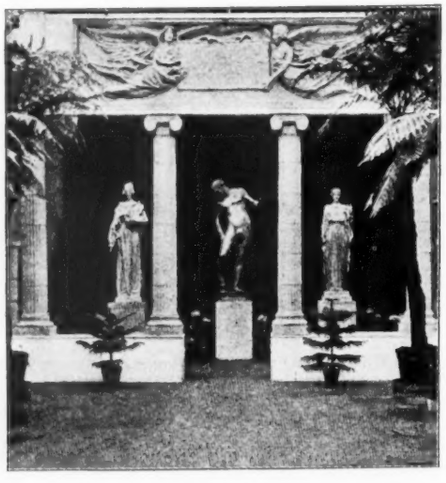
DESIGN FOR SUN-DIAL.
Henry Bacon, Architect. A. A. Weinman, Sculptor.

execution, is characteristic of this class of work. The cause of this seems to lie more in the insufficient regulations than in the lack of ability of the sculptors employed. For instance, the buildings for educational purposes have proved to be very fertile ground for art, especially libraries and universities; among them the libraries of Washington and Boston, the Columbia College in New York and the University of San Francisco show what our sculptors are able to do if they are allowed to execute the products of their fancies in pure material.

Referring to our office and business buildings, the requirements of our democratic time are in many ways against the employment of sculpture work to any extent, as their main care is to provide space and light. Therefore only flat ornamentations are employed for their decoration. The decoration required in churches now is insignificant as compared with that of former centuries, when hundreds of artists were chiefly employed in such work.

The idea of building a homestead for centuries has vanished in this era of railroads. The owner is aware of the fact that he may be compelled some day to sell his house on short notice; he therefore prefers to satisfy his artistic desires by means of movable pieces of art in preference to adornments connected with the building itself, as those embellishments prove in many cases to be rather a disadvantage in securing a purchaser.

In reference to interior decoration, the architectural sculptor is limited to theaters, halls, clubhouses, restaurants and saloons, which latter, in the public opinion, are not to his advantage. In contrast to this, one of the most attractive grounds for the sculptor are the exhibition buildings, which during the last thirty years have given to them the best opportunity to show their power, although very rarely in any other material than staff. In this field they arepermitted to produce the boldest fancies, modeling enormous groups of human figures; and the greater number of our sculptors of national reputation owe their fame and the admiration of the public to works done in the so-called "White Cities." There is no



doubt that monumental buildings and exposition buildings will in the future represent the only opportunity for the sculptors to make themselves acquainted with the desires of the people. In this work they will find a compensation for what they have lost in the building of churches and castles of former days. The number of those employed in this art in this country is yet very limited, and restricted to a few of the large cities only. This small number is still complaining of insufficient occupation. Not appreciating the value of artistic work, owners and architects often make the mistake of letting this work to a general contractor, the stone-carving to the stonecutter, wood-carving to the carpenter or cabinetworker, and the ornamental stucco to the plain plasterer. It is evident that the contractor will be mostly interested in his own work, and will try to place the art work with the lowest bidder. The artist as a subcontractor will always offer a pitiful feature, working without zeal and self-consideration.

QUADRIGA OF VICTORY, BY J. Q. A. WARD.
Surmounting the Dewey Arch, New York.

It would be desirable that the architects should pay more attention to the architectural sculptor's work, calling repeatedly at their studios, criticising their work and encouraging the artists and their assistants by praises or censuring. There is also such an amount of technical knowledge required, which can only be secured by viewing the work in progress, and without which knowledge no architect will be able to do himself credit in making designs and details. The sculptors know by experience that they never will be able to explain the particulars of their business in words, and there are no technical books which would fully explain, as their work can only be understood by carefully watching its progress. I therefore will not attempt to enter this field.

FINE INTERIOR WOODWORK.

BY F. E. KIDDER, C. E., ARCHITECT.

NEVER in the history of this country has such fine work been done in woods, at least for house finishing, as is being done today. It is true that some very good work was done in the Colonial period, especially in stair and mantel work, but most of the work was painted, and the members were not as fine as at the present day. It is, in fact, difficult to find a piece of Colonial work that would be considered first-class in execution by the architects of today. True, the Colonial work, being entirely done by hand, possessed an individuality that is lacking in machine work, but in the best modern work the individuality is obtained by special designs, inlaying and carving.

Even at the present time, however, a great deal of woodwork is decidedly inferior to the average of that done one hundred and fifty years ago, because of the rush with which everything is now done, and the low prices at which much work is taken. Then, again, house carpenters do not as a rule learn their trade as thoroughly now as in the olden times. Indeed, the modern house carpenter is employed mostly on rough work, and the only fine work he has to do is in putting up the finish, which has been worked, smoothed, sandpapered and largely put together at the mill. The trade of the joiner has merged into that of the cabinetmaker, and is followed only by those men who work in a mill or factory.

To obtain a strictly first-class job of fine interior finish, outside of a few of the larger cities, is a difficult undertaking,

and one that requires a great amount of watchfulness as well as technical knowledge on the part of the architect, great care in preparing the walls and rough work to receive the finish, good mill facilities, with ample floor space and skilful men to do the work and time to get it out, and much money to pay for it. As with nearly everything else, a beautiful room depends

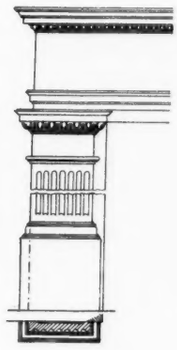


FIG. 1.

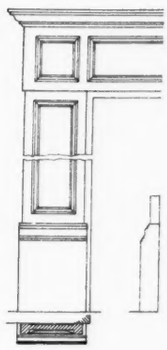


FIG. 2.

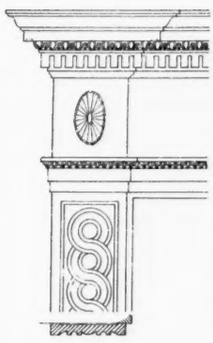


FIG. 3.

very largely upon the work and artistic thought put into it, and without these the work can not be a success, no matter how rich the materials employed. For the best work, however, of course only fine materials should be employed.

The defects in interior woodwork are due to many causes, the chief of which, perhaps, is that not enough money is paid and time allowed for the work. Even when these causes are eliminated, however, the finish may be only second or third class, because the walls were not dry, the grounds were not properly put on, the plaster was not true to the grounds, the

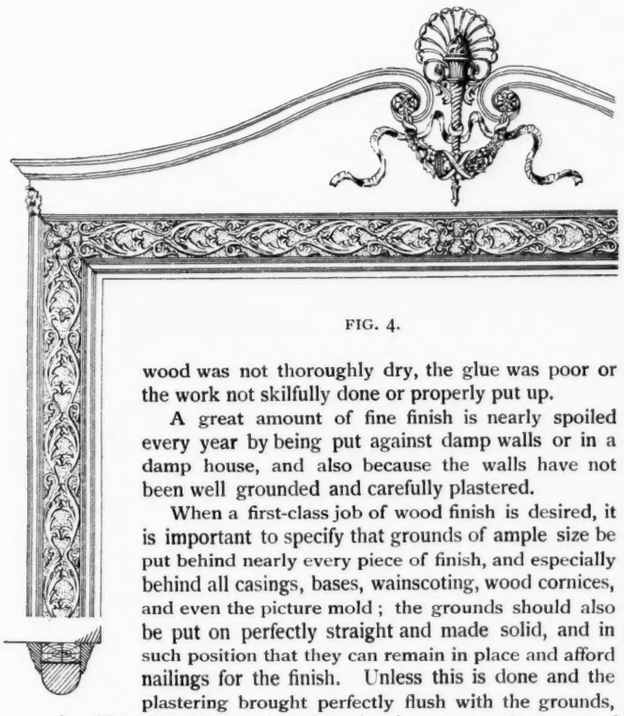


FIG. 4.

wood was not thoroughly dry, the glue was poor or the work not skilfully done or properly put up.

A great amount of fine finish is nearly spoiled every year by being put against damp walls or in a damp house, and also because the walls have not been well grounded and carefully plastered.

When a first-class job of wood finish is desired, it is important to specify that grounds of ample size be put behind nearly every piece of finish, and especially behind all casings, bases, wainscoting, wood cornices, and even the picture mold; the grounds should also be put on perfectly straight and made solid, and in such position that they can remain in place and afford nailings for the finish. Unless this is done and the plastering brought perfectly flush with the grounds, it will be found that the plastering is wavy, perhaps out of plumb; and altogether in such shape that it is impossible to bring the finish to the plaster without twisting or springing it, and often it can not be brought against the plaster except in a few places. It has been the writer's experience that it is more difficult to get the walls properly prepared for the finish than to get good finish. The condition of the building when the finish is brought to it is also a very important factor. The plastering should be thoroughly dry, and the rooms as free from moisture as it is possible to have them.

The best time of year in which to finish a building is in the winter months, as the heating apparatus can then be kept in operation and the air kept dry. In the summer months the workmen can not endure artificial heat, and the air in the rooms is consequently of about the same humidity as that outside. Even on the hottest summer day the air is not nearly as dry as in a furnace or steam heated house in winter, and in some localities dry air in summer is quite uncommon. The main point to be considered and attained as closely as possible is to have the wood dried in a kiln or "hot box" to such a point that the artificial heat in winter will not affect it, and to get it from the mill to the house and in place and varnished or painted without its absorbing moisture. This is something quite hard to do, but it can be done.

The designing of the finish, i. e., in regard to the way the pieces of wood shall go together or be built up, also has a great deal to do with the final appearance of the work. That the finish shall be worth the labor and thought expended on it, it should obviously be of an artistic and appropriate design, but this can usually be attained in several ways, and it is better to use a comparatively plain finish that will stay in place and not show open joints than to use a more elaborate finish that will open at nearly every joint. In designing standing finish, therefore, the architect should first consider what the chances are for obtaining the requisite conditions for a first-class job, and if he thinks that it is doubtful about obtaining the necessary degree of dryness, and careful preparation for the work, he will do well to make the finish of such a character that it can be fitted to uneven walls and not be badly affected by shrinkage. It also makes quite a difference whether the work is to be painted or varnished, as in painted work open joints may be filled, but in varnished work any perceptible shrinkage mars the appearance of the work almost beyond repair. The ill effects of shrinkage may be largely overcome by avoiding miter joints and either using corner blocks or treating the casings as pilasters, with caps or corners made of a separate and slightly thicker piece. Pilaster casings with corner blocks, which may be carved if desired, is the simplest finish for avoiding the effect of shrinkage, and when something better is desired a finish like that shown in Figs. 1, 2 or 3 may be used. Neither of these designs will suffer much from shrinkage. For very fine finish, where all the conditions are favorable, the work should either be built up with several narrow members or the broad surfaces veneered on a pine back. The work should also be put together at the mill as far as possible, and painted on the back and filled and shellacked on the surface before it leaves the mill. In the best work the head and side casings are joined together at the mill, so that no joints have to be made at the building, and if the wall is perfectly true but very few nails will be required to hold the work.

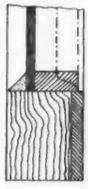


FIG. 5.

When the casings are quite thin, however, unless the walls and grounds are perfectly straight and in line with the edges of the frame or jamb linings, it is better to put up the finish piece by piece, as if put together at the mill the joints are liable to open in fitting the finish to the wall.

A better job of work can usually be obtained by using comparatively thick finish rather than thin. Fig. 4 shows a section of door finish recently used by the writer, which was all put together (except the head ornament) at the mill, and was very easily secured in place. Finish like that shown in Fig. 2 can be framed together with mortise and tenon, and make a very strong joint. In the finish shown in Fig. 1 the pilasters should be got out complete at the mill, with all moldings glued on and the head casing made complete, but each should be put up separately. If there is any chance for shrinkage, however, then the

cap should be a separate piece and the moldings nailed on instead of gluing. For a first-class job the finish shown in Fig. 3 should be all put together at the mill, with the side casings extended to top and the head casing framed into it. With finish such as is shown in Figs. 2, 3 and 4 it is possible to glue the finish to the edge of the door frames, holding it in place till the glue has set. The writer is informed that in Scotland nearly as much glue is used at the building as at the shop, and that everything is glued wherever possible. The best work in this country is largely put together with glue and perhaps a few screws. Such work, of course, must be very carefully done and requires a good deal of time and ample room in the shop. It is doing no injustice to say that not every mill is equipped for getting out first-class wood finish.

There are a few details of finish that may be briefly touched on as being important in first-class work.

Veneering.—Veneered work is undoubtedly superior to solid work, if the veneering is properly done, and certain kinds of hardwood finish, such as doors, wide panels or friezes, must be veneered to give any sort of a job. Even a first-class pine door should be veneered. The advantages of veneering are that the wood, being very thin, is thoroughly dried, and when applied to a core built up of small, dry pieces of pine, there is no tendency to warp or shrink. Two kinds of veneer are used in housework. The more common kind is about $\frac{3}{16}$ inch thick, and is always sawed. Many of the mills saw it from ⅞-inch boards as needed. The other kind is only about $\frac{1}{20}$ of an inch thick, and some kinds, such as bird's-eye maple and curly birch, are made by cutting off a thin layer around the log. These thin veneers are only made from selected stock, and can be obtained in pieces two or three feet wide, so that a panel three feet wide can be veneered without showing a joint. With the thicker veneers it is necessary to match the pieces, when the work is over 12 or 14 inches wide. Some persons probably have an idea that it is cheaper to use thin veneers than to use solid wood. This is not so except in the case of very rare woods, and where a factory is especially fitted up for that kind of work. The ordinary woodworking establishment finds it cheaper to use mahogany even 1⅛ inch thick than to veneer it, and the very thin veneers are but little used outside of furniture shops and a few mills in Chicago and the Eastern States.

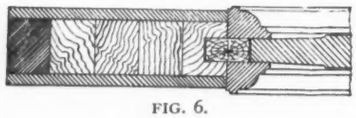


FIG. 6.

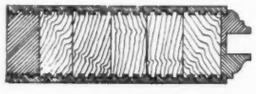


FIG. 7.

Veneered work should always be veneered *both sides* where there is any chance for the work to warp, otherwise it will warp and twist badly. Doors, especially, if veneered on one side, must be veneered on the other, if only with pine. Sash for outside windows, however, may be veneered on one side only, if they are 1¾-inch thick or more. The writer usually has the outside sash for windows showing in rooms finished in hardwood, veneered as in Fig. 5, and has always found them satisfactory.

Panel work should always be put together with loose panels. Doors should be made with a spline to receive the moldings, as shown in Fig. 6, otherwise it is difficult to secure them without gluing or nailing to the panels.

One firm in the country is now making what they call a compound door, the difference from the ordinary veneered door being in the dovetailing of the veneer to the core. (See Fig. 7.)

Hardwood Flooring.—Most of the hardwood flooring now used is manufactured in the lumber regions by concerns that make a specialty of flooring, and is sold to the different lumber dealers throughout the country. Oak and maple are the most satisfactory woods for floors. All of this "stock" flooring is matched, and the best quality is also matched on the ends and bored for the nails. The usual width is 2¼ inches on the face. The stock is supposed to be well air-seasoned and kiln-dried before it is stuck, and considerable pains is generally taken to keep it dry afterward. For a furnace-heated house, however, it should be put in a kiln or hot box for two or three weeks just before being laid. To obtain an absolutely perfect job of flooring the boards should be rejointed by hand as the floor is laid.

Parquetry.—When something handsomer than a plain oak or maple flooring is desired it is best to use *parquetry flooring*. This is now manufactured by several parties in this country, and a very good quality of flooring, in almost any design or any combination of woods, can be obtained. The common thickness is $\frac{5}{16}$-inch, and it is usually made up of slabs 12 or 18 inches wide and 3 or 4 feet long for centers, and 6 to 24 inches wide and 12 feet long for borders.

Thin parquetry should be laid upon a double floor, the upper thickness of which is of kiln-dried clear white pine, furred up if necessary so as to be perfectly level, and smoothed and traversed by hand as if for a finished floor. On top of this pine flooring the parquetry is laid, commencing either with the center or with the border as may seem best, and secured by 1¼-inch wire brads. The brads are driven through from the top and sunk for puttying, from fifteen to twenty brads to the square foot being used where the pattern is in small pieces. Gluing the parquetry to the floor is not recommended.

For further investigation, see:

Timber: Its Properties and Characteristics, Bulletin No. 10, U. S. Department of Agriculture, 1895. Club Furniture, *Inland Arch.*, Vol. XII, pp. 78, 93. Wood Carving, *Inland Arch.*, Vol. XIII, p. 100.

ORNAMENTAL METAL-WORK.

BY W. W. KENT, ARCHITECT.

TO bring beauty out of crudity, form out of mass; to give an expression of life and imagination to materials which await the touch of a creative hand—these are the delightful tasks of the designer.

The fascination of an artist's career lies somewhat in the materials with which he works, that is, in the possibilities which the characteristics of the materials suggest, and he who does not keep within the possibilities of his medium soon reveals qualities of decadence, or, to say the least, of mediocrity. The man who makes in an etching, for instance, an effort to secure qualities which could better be secured by lithography, is working outside the possibilities of his medium. It is, of course, difficult to explain just how far one can successfully go in certain directions with certain materials and processes, but even laymen recognize intuitively when the boundary line of possibility has been passed, and feel an instinctive dislike for the consequent result. It is impossible in brief space to state just what should or should not be attempted in any medium, but there is one fundamental law that designers generally recognize, and in fact one may say that, in such degree as they do recognize it, they may be called artists. That law is that no process should be carried to the point of absolute deception, and no material should be wrought into the semblance of another material, when the resulting shape could better be secured by use of the material of which the characteristics have been imitated. All materials or mediums have peculiar qualities, and he who most keenly appreciates this and knows how to bring them out to advantage is working in the right direction, no matter how far he comes from the ideal. In fact, this gift of appreciation is a distinguishing mark of talent if not of absolute genius.

Let us, for instance, suppose that we wish to make an ornamental panel, and our given or selected medium has as its chief characteristic plasticity. How strained and far from the mark it would be to attempt to carve it, instead of modeling it into the desired form. Again, take a substance which is ductile; would you naturally make its ductility count and come out

strongly in your work, or would you try to mask this valuable quality by making a casting?

These may seem needless questions to ask, but the principle involved is a vital one in all good craftsmanship, if not in all art. On every hand we see in the city streets materials wrongly applied, wrongly wrought. Galvanized iron balances awfully on cornices in forms which it would be unsafe to repeat there in the real article which it falsely represents, and yet galvanized iron has its beautiful uses, properly wrought and placed.

FLORENCE — COVER OF ANDIRON CHEST.
By Michael Angelo. (In the Bargello.)

Of all the current errors of this sort, perhaps the most frequent are those connected with the use of metals, and they are made even in places where we see other work logically and beautifully carried out. We see cast iron masquerading as wrought, in order either to save a few dollars or to show how clever the designer can really be. The story of a famous architect comes to my mind, who found one of his pupils designing with evident labor and pride a queer feature in a house interior in order to escape the results of what the necessities of the case demanded. "That's clever," he said, to the neophyte's joy, and then crushed his budding enthusiasm by adding, "but we never do clever things here."

Now a word for abused cast iron. Why has it been placed so low in the scale of metals which can be used ornamentally? One reason is possibly because it is brittle, another because it is cheap, but the chief reason is probably because its cheapness has led to its substitution for more valuable metals. Can any one say that this cast-iron chest panel by Michael Angelo (now, I think, in the Vatican) is not in a wonderful degree beautiful? If the iron does not lend itself to this design, or rather if the design was not made in keen appreciation of the qualities of the metal, it is impossible to say or guess what could have been the thought which brought design and medium into such perfect harmony. The very incompleteness of certain parts and the bold, but we might say refined, crudity of the figures are delightful. Here, I firmly believe, is one of the great master's most instructive works. Certainly nothing a hundred times grander or richer could tell more of the appreciation which the designer felt for his medium than this. It is sympathetic in the best and strongest sense, and the cast iron has been ennobled by the simple emphasis of its qualities. How would he have done the same thing in bronze? Probably by making a finish where high lights would count with color more than iron would admit of. That is, with possibly more finished and burnished modeling and with greater delicacy of design.

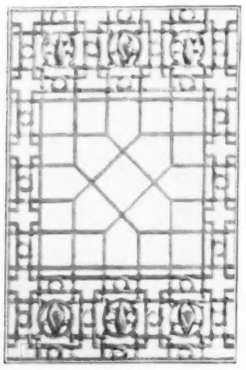
To come down to the Middle Ages, see what the French did with firebacks and andirons in cast iron. You will find excellent examples in the Cluny museum and at South Kensington. Even in England in the eighteenth century firebacks of good design were produced, and preceding this some interesting cast-iron work was made at Lewes, Sussex, the origin of the foundry dating back to the days of Henry II in 1266. A modern bronze casting is represented on page 32 which is purely a design for casting and not for any other method of manufacturing, and is a very interesting and charming design.

The commonest misuse of cast iron is in the imitation of wrought iron or bronze, where cast grilles, hinges, etc., are made to pass as wrought work. As a basis for electroplating and in heavy forms the use of cast iron, although a palpable fraud, is hardly as weak as where the form of a malleable or ductile metal is imitated. An example of a delicate grille made by an American foundry, and of the writer's design, is shown here as an example of the legitimate use of cast iron. The slight roughness of an iron casting is interesting, and by refining or coarsening this, according to the design, considerable life and vigor can be obtained.

In the shaping of wrought iron the commonest fault is not imitation, but a careless use of its malleable and ductile qualities. As a nation we make wrought iron so much more heavy and clumsy than strength and good design demand, that it is in many cases ridiculous if not absolutely offensive. There is of course no hard and fast rule to tie to, but the possibilities of refinement, grace and strength in combination are so well known to an old ironworker that a green hand's efforts at design are quickly detected. Watch the forging of a horse-

shoe by a country blacksmith and you will often see that "the smith, a mighty man is he," for other reasons than that he has strong arms. He feels the ductility of the metal at every blow, and he can often put in a graceful outline with a few strokes.

An interesting experiment was made some years ago at the writer's suggestion to see how good a grille might be made by



CAST GRILLE.

the use of certain stock forms of rosettes made for the trade, when placed on a framework of wrought iron, and the result was interesting if nothing else. The experiment could be carried further, with good chances of securing better results. One danger is avoided in work of this sort, and that is that of representing flower forms in too realistic a way. The stock rosettes have a certain architectural stiffness and dignity which when offset by graceful handwork are exceedingly telling. Realistic roses and other flowers in wrought iron are not apt to be beautiful when entirely freed from conventional handling. In rococo work of the best period we find the safe limit of free treatment reached, and when succeeding artisans passed beyond it the decline was noticeable.

It is in the Orient and among the Latin races that we must look for the best examples of ornamental metalwork in the past. The grilles and gates of the Spanish cathedrals — the braziers, with bronze or brass studs and nails, the wrought-iron bosses on the massive doors of public and private houses, are well known to travelers and students. Mr. Prentice, in his book on the Spanish Renaissance, has given many interesting examples.

Where it is desired to use color on metal, that is, to apply color to it, better results are obtained if paints can be avoided, especially on metal exposed to the elements. Paints fade and run and need frequent renewals. On ironwork the surface may be preserved by the use of several patented processes known to most metal-workers; and when copper, brass and bronze are employed, acid treatments are made especially effective; and by careful experiments I think even better colors might be discovered than we have so far obtained. Just why all modern iron or bronze work should be colored green, irrespective of its place or function, it is hard to say. We see it now on mausoleum doors and café signs, on clubhouse cornices and bank signs, until it seems done to death. There are other acid stains quite as beautiful as Pompeiian green, and while as a scenic effect it may be permissible on the cast-iron railings of the Manhattan Hotel in New York and the roof of the Grand Central station opposite, this is no reason why it should greet us as the correct thing at every turn.

But more beautiful than any superficial coloring are the rich alloys in copper and bronze which the more progressive of hardware concerns have been experimenting with. The chemical laboratory is now an indispensable part of the more modern and extensive metal-working establishments. What glowing richness in the royal red or dragon's-blood copper alloys, every change of any constituent part producing a different tone with all the lavishness of kaleidoscopic or symmetroscopic effects — and, by the way, no designer — whether in glass fabric or metal — should be without the symmetroscope. It has all the advantages of the kaleidoscope and improves upon it immensely. By its use one can photograph the most charming combinations of conventionalized flower and other forms in a constantly changing variety of shapes and colors — of course it not being possible to secure the latter by the camera with any degree of cheapness; and as yet the pentagon is the basis for all patterns in it as now made, but even with these limitations it is of immense use to all artists.

One other consideration about ornamental metal-work is where properly to use it. Probably few men need to be told of the field there is for it. For both protection and use it may properly be ornamental in character, and the Pompeiians have shown us that even common domestic utensils may be made beautiful, and things for our cooks and maids to admire rather than to smash; nor do I believe that great expense would follow the good designing of such things, while the effect of beautiful objects on even the dullest mind is, I contend, not only not bad, but positively elevating, in spite of that pessimism which says — and says it often — that all art is degeneration.

Where are the old street signboards of the mediæval craftsmen? Why can we not expect to see a revival of these surpassing all that has gone before? Here was one of the most

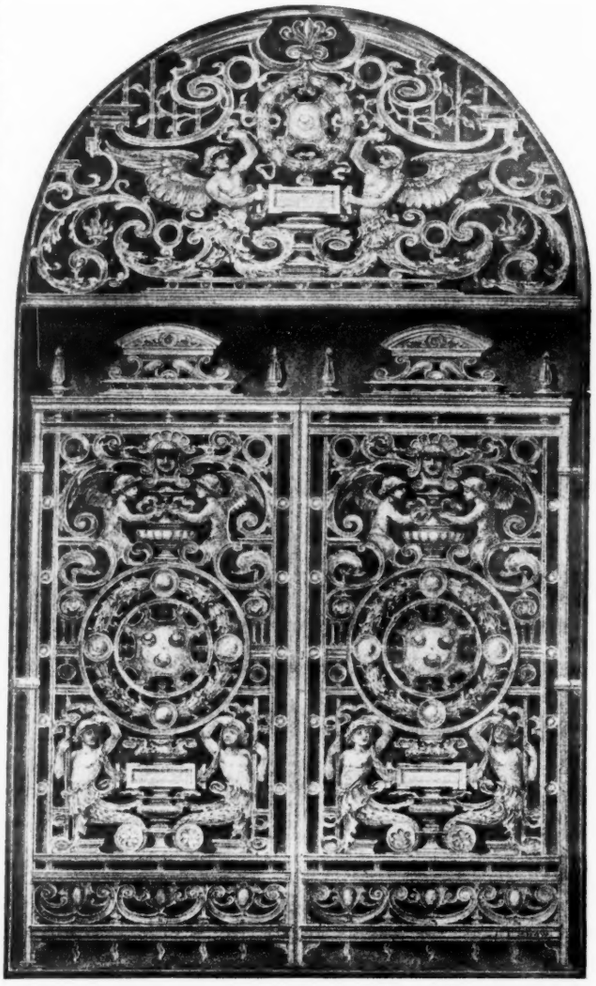
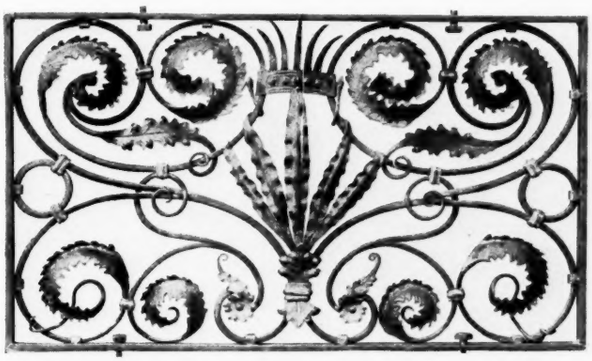


ILLUSTRATION OF CAST BRONZE GATES.

practical applications of metal, the beautiful lines of the supports being a constant reminder to the passer-by that something besides money-getting occasionally occupies the proprietor's mind. We Americans live so much in the business world that it is almost a necessity that we should put into our surroundings at least some few excellent things in design, and I for one must disagree with Ruskin when he says that a chimney is not



GRILLE SHOWING GOOD CONVENTIONAL TREATMENT OF LEAF FORMS.

to be ornamented. Let us make even our factories beautiful and we — well, we may perhaps even do away with the necessity for future Ruskins.

We are, on this North American continent, only opening our eyes to what the future may bring us in art, letters and wealth, and with zeal the latter may be kept in its proper relative position of handmaid to the other two. No nation not sunk in self-indulgence ever spent so much on attempts at beautifying daily life as citizens of the United States are spending today, and in it really lies one of our safeguards. Windows, elevators, stairways, areas, doors, are all of them in certain buildings fit places for ornamental metal, while bank interiors are hardly to be made safe for the employes and directors without metal screens and railings. Cornices, finials, balconies, fire-escapes, and even entire roof-gardens, may very properly be put into metal and metal shapes only. With the rapid spread of fireproofing for office buildings, we must expect to see many more pieces of fixed or portable furniture made of metal — and demands will be made not only that it shall be practical, but that it shall be good in design and execution. No window or door grille will be so considered, no matter how good its motif, that can not be swung open or got at for cleaning, and whose security when fastened can be successfully questioned, and so on, the practical generally coming first, as it must, and the beauty of the design taking second place. We have seen metal embedded in glass within the last few years to make it stronger and more fireproof, and the next step will be to make good designs, not necessarily more complicated, but more graceful and interesting than the woven galvanized iron-wire meshes now used. Then we can put it in plate glass in conspicuous places and secure strength, cleanliness and beauty in combination. Doors of wood are already protected by covering them with metal, and the practical has been so successfully attained in this direction that the next move to make the metal surface interesting in color will perhaps not be long delayed.

The Orientals obtain excellent surface and perforated decorations in metal by the use of acids and asphaltum or protective "resists." We have long tried it also in this country on an extensive scale, but owing, I believe, to the fact that we can not use the electric light in place of the sun for photography, it has failed to be commercially successful, and is employed now chiefly for making tablets and signs, in which work a dark day now and then does not interfere with the execution of the average design.

In speaking of the Latin races as the foremost workers in ornamental metal, of course it is not without due recognition of the often beautiful and always vigorous work of the Teutonic race. There is, however, often in German and Scandinavian work a lack of delicacy, of poetry and of repose which the Spanish and Italian has in such great measure. The German seems never to have been influenced so much by Eastern examples as the Latin was. This is made clear by comparing Asiatic and Indian work with some of the French or Venetian grilles. In some cases the patterns are almost identical. The railing of a balcony in a certain house in India is nearly the same as that of a grille in a mediæval church in central France, only treated in a far more interesting and graceful way in the Indian example.

Mr. Jackson, in his entertaining three volumes on "Dalmatia, the Quarnero and Istria," speaks of the beauty of the designs in metal on the east shores of the Adriatic, and gives good drawings of some church plate, until one wishes he had also photographed some of the simple iron grilles and other more ordinary forms which he found there. These must have been of more than ordinary merit, owing to the mingling of Venetian and Oriental characteristics observable in much of the architecture of these countries.

In southern Italy and in the east and north of Italy we find beautiful metal-work cast in small plates, in the bronze doors of the various churches, which were the work of Greeks or of their followers. One door at Ravello, above Amalfi, is extremely good, and the door of the cathedral at Verona is

DAMAS — COMBEAU DE LA FILLE DE MAHOMET.

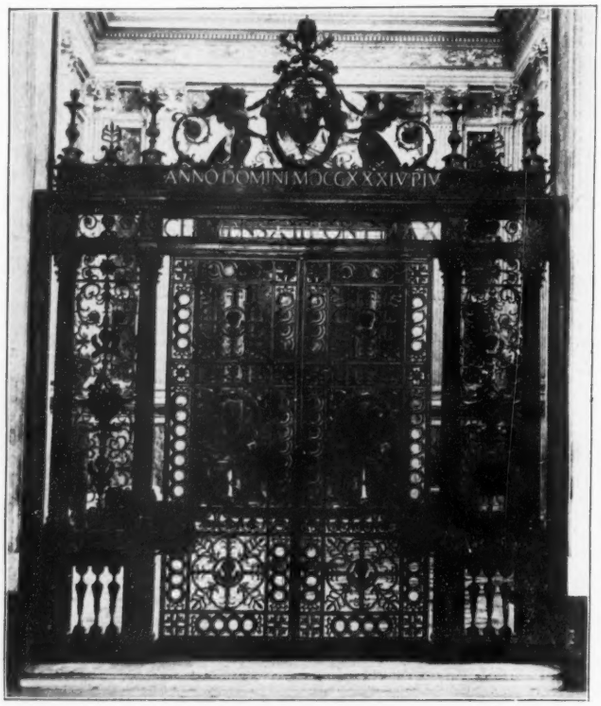
widely known and admired for its vigorous and decorative effects, obtained by raised surfaces in conjunction with perforations.

Here is an Oriental guard around the so-called tomb of Mahomet's daughter near Damascus — a conventional use of the sunflower being the motif — and, while it is curious, we should hardly like to see it used again in connection with a mortuary monument. In the Church of St. Apollinare, in

Classe, near Ravenno, the apse has in a crypt window a beautiful, though crude, grille which is ecclesiastical, though based on a classic design of imbrications or garden loops one over the other, filled in with the cross.

The little towns of Normandy and Brittany are full of good and simple specimens of balcony railings, and they are so common as to catch the eye at every turn in certain parts of the towns, encouraging one to hope that some day we shall see our own town windows and balconies furnished with equally good and useful protections, which are, at the same time, educational and pleasing to look at.

A word here about the excellence of much of the metal-work product today by American firms and individuals. We have all seen it improve wonderfully in character in the last ten years, rising from the cast-iron door grilles, of stock design, turned out by the iron foundry from a foreign book of patterns up to the thoughtful and well-studied examples executed now



ROMA — CANCELLO DELLA CAPPELLA CORSINI IN S. GIOVANNI IN LATERANO.

by specialists and often designed by architects who do not put off such details on the office boy along with tracing and blue-printing. We are, on the whole, in spite of much bad art in metal-work, making a great step forward, and as soon as we learn to forget our text-books and photographs, and think for ourselves on the basis of what these examples have taught us, we shall produce work worthy to endure.

If our designers would only remember that a bad thing done in metal is a long-lived reproach on account of its enduring quality, they would hesitate before sending out a sketch which may continually hurt, not only the public eye but the good name of its author. In this connection, a conversation on the train between two gentlemen who met by chance interested me. The elder, who had seen some years of service in the city government of Philadelphia, was bewailing to the younger man, an architect, the fact that while he was in the city employ years ago, and in a position to vote on the passage of an appropriation for building that public monstrosity known as the City Hall, he was unable to do anything to effectively head off appropriations, although he voted against it. "I consider it," said the elder man, "as a colossal mistake and of the most expensive kind." "Yes," said the architect, "and the worst of it is that such a pile is sure to last many years, if not for centuries."

Think of this, you to whom the delightful task is entrusted of doing a good, sensible, beautiful thing for the eyes of your daily business brother to see, that what is done in metal is also long-lived and should, therefore, even more than ordinary objects, be most thoughtfully and conscientiously designed. If you can not design metal-work full of the divine essence of genius, you can possibly at least make it inoffensive.

INTERIOR DECORATION.

BY JAMES WILLIAM PATTISON.

NOWADAYS men have no courage; only women are brave — that is, decoratively. Back in the seventeenth century, when Charles II., of good clothes and easy morals, lived, we are told by Samuel Pepys how both king and commoner decorated themselves. Mr. Pepys was well educated, and, being a commoner, had the good sense to hold office, not being born to rule. He wrote a diary all about the king and nobles, and actually kept his head. Now, from this diary we learn our lesson for today in the matter of interior decoration.

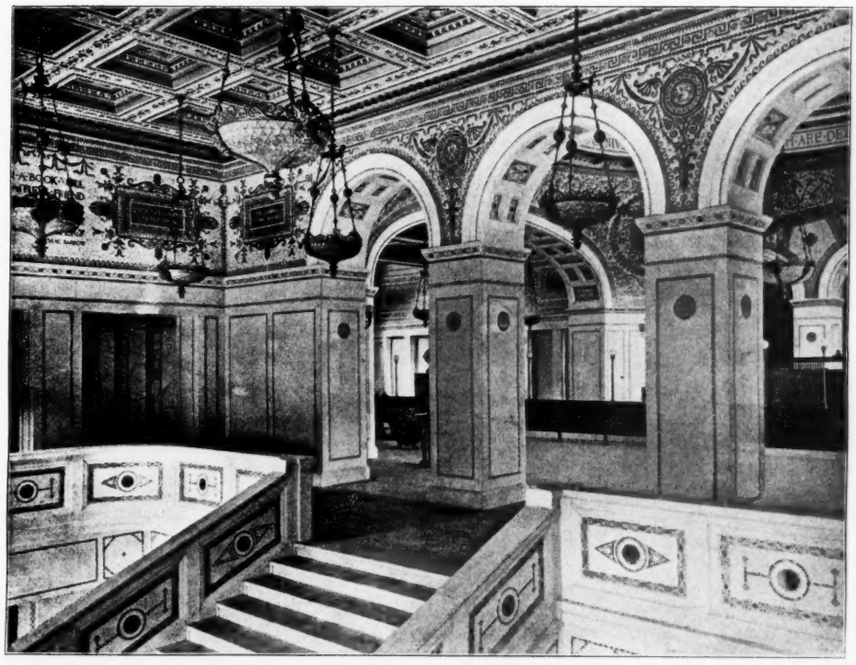
Men had courage in those days, and Pepys, as innocent as a boy and as joyous as a woman, tells all about his silk coats and scarlet garters, bows and flowing streamers. It seems that this commoner rejoiced in gay colors, but the king wore richer-toned gear; and we are like that in our interior decoration. Our diarist tells also of Nellie Gwynn, the actress — of how she once put on a cavalier's plumed broad beaver and looked very pretty in it — adding, "indeed she would look pretty in anything." Nellie must have been a rare bit of "ornamental structure." Even refined structural beauty may, it seems, be ornamented. So this pretty woman in the big hat that was not made for such as she raised that eternal question about when, how and how much we shall decorate.

An examination of many interiors in Chicago, with a view to studying artistic effect and the use of materials, brings us painfully in face of this question, "Is it of any use to decorate?" Looking at the halls of the Stock Exchange and the Board of Trade, both handsomely wrought and both neglected, we are tempted to say, "No," and would say it except for the fact that such good things, such serious efforts, each a good representative of an epoch in our art history, may lead to an improvement in our habits.

Chicago is so patriotic in its noble endurance of grime that it should at once dress its women in black and its halls in marble. Marble seems to get along comfortably with one of the principal products of Illinois. At the Board of Trade I was informed that the sixteen-year-old decorations have been cleaned but once, and that was seven years ago. When the decorations become of age and grow self-conscious they will no doubt wash oftener. Not much is to be expected of a child in his teens. It has been suggested that the delicate color decorations of the Stock Exchange could be easily cleaned but for the great cost of a scaffolding. But why? We can be as witty as other folks. I once saw in one of the big halls of the Louvre a tall tower of wood which was on rollers, and two men were up there cleaning or repairing. A section being completed, they got down and moved the affair along to a new spot. Also, one may imagine that the construction of the ceiling of the Board of Trade invites the laying of boards within easy reach of the dirt. It must be that we love the dirt because it is a Chicago product, else we would be rid of it. But as it is, we must use such material in decoration as will defy dirt, and this brings us to some limitations in our study. Back again to Mr. Pepys and his taste for cheaper and gaudier, we must compare paint with marble, cheap metal with bronze, painted ornament with

mosaic, for it seems as if we all must be kings and wear costly stuffs or else look frowsy.

All marble has "quality," as gold has quality. This element is indescribable but may be easily understandable when we say that ordinary painted surface has no quality or that brass has little and gold much. There is a tone and surface that is conveniently described as having "quality." Imitation marble has no quality. Look at the many examples of it; the mottled stuff is not even as like its original as "nearsilk" is like the real thing. Its only merit is that it will wash. Mr. Architect, do not frown at me for saying this. You would not use it except for the same reason that Mr. Pepys wore scarlet garters. His purse and taste and your patrons' are alike not royal. For yourselves you would use honest stone that has quality.



DECORATION, CHICAGO PUBLIC LIBRARY.
Shepley, Rutan & Coolidge, Architects.

Mexican onyx is sufficiently genuine and has a measure of quality. It is very suitable for certain interiors. In my lady's boudoir a very little would go a good way. But the onyx is far more respectable than the mottled composition, and it "keeps"—which the latter does not, but only grows dingy and still cheaper-looking in a few years. Then the composition is so easy and one can spread so many colors with it, just as Pepys could wear scarlet garters with bows and streamers to his vulgar heart's content.

There is an entry-way and stairs to an office building, all in white marble (gray-veined), but quietly varied by pilasters in very pale onyx. There are many similar entrances and stairs in all-white marble, relieved solely by paneling. These vast, expansive surfaces of this cold, silky stone are decidedly impressive; the quality in the goods tells. Indeed, there is a certain respectability, a royal air about the white that is denied the colored marbles. In going from the south entrance of the Public Library to the opposite end, one feels this. As to whether the warm-toned marble is like sunshine and the other like snow is not quite to the point. Sunshine on snow is certainly wonderfully impressive and carries us off our feet when summer sunshine would not stir us. The white is more regal. But it is a trifle deathly in tone; one might say saintly. Even the angels have pink wings, you know, along with their white array. What, then, shall be used to ease its puritanical perfection? Too much will certainly result in vulgarity. The king's silk may be embroidered with silk only, unless it be with gold. If the Parthenon and the Venus of Milo were originally painted, would that we might have been there to see. What could it have been like? Possibly M. Gérôme has solved the problem. His "Pygmalion," at the Columbian Exposition, two figures in very fine marble, was tinted very delicately, but not enough to destroy the "quality" in the marble. The flesh was faintly

IN CONGRESSIONAL LIBRARY.

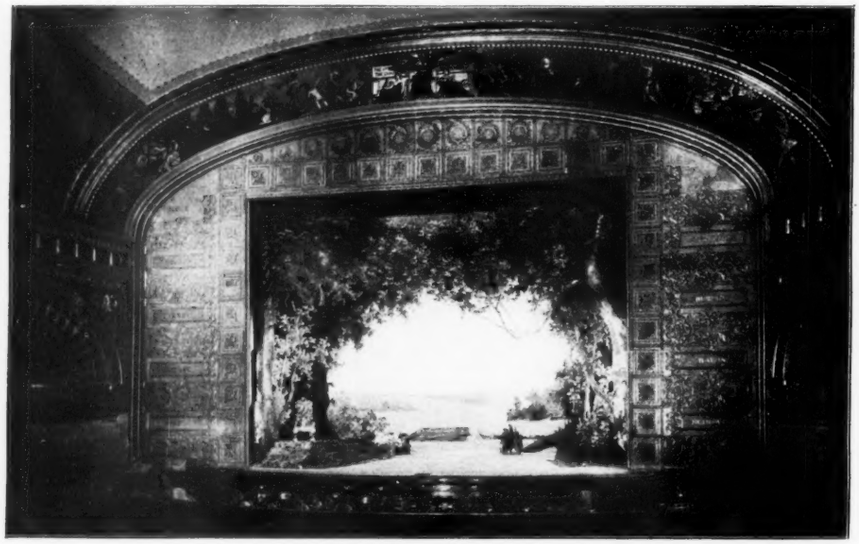
flushed with warmth and the garment of Pygmalion took on a very delicate tint of greenish color, besides some quiet trimming in other tones. It was scarcely painted, but only stained. Could we do something like that, which had no cheapening effect upon the stone, great things might result. But even Gérôme missed it in his "Bellona," of marble and bronze in several tones. That was elegant and costly, but not noble. He went too far.

Bronze is certainly worthy of marble, and it may be toned to great variety and made very decorative. There is an endless field, as yet uncultivated, for an ingenious architect in this line. But he must have a fine color sense. Nothing is so kind to marble as gold, and it has been very judiciously used in Chicago. There are capitals entirely gilded or narrow panels in which some ornament occurs *rehaussé* with gold. Modestly administered, nothing could be better, but the gold must be fine metal. In the Congressional Library the somewhat too abundant gilding is of coin fineness and it will endure the centuries.

As regards combination of painted decoration with white marble the Washington library is a lesson to us. The great Stair Hall is one fine sweep of white marble, relieved only by the variety in the blocks and the abundant sculpture and carved ornament. This profuse carving changes the surface color slightly as well as enriching it. But on looking up to the vaults overhead one sees strange contrasts — contrasts of color, and, worse yet, contrasts of quality. Color contrasts are good, if harmonious, but contrasts of texture and quality are more difficult. Two sorts of silk may be put together, or silk and velvet are kind to each other, but silk and cotton on the same gown or the same wall make the gods angry. In Washington we have this contrast — silk in the marble and cotton in the painted decoration of the second-story vaults. The lower vaulting is mosaic, the upper is paint. One is quiet, being of the same quality as the marble, it is very harmonious; the other is garish, the work of workmen and not of artists, and it is cotton. Of course I do not mean the panels painted by skilled artists, but only the renaissance, painted ornament, done by men who worked for day's wages and not for love or glory. The "people" complain that the effect is garish, and quite rightly; our business is to determine why. It is not stated here that white marble and paint may not be placed together, but it is declared that in our present state of mural painting the effect is rarely good, and the reason is plain. Our artists can paint panels to match almost anything, but our journeymen can not do it. But even our artists find it difficult to unite paint with a silken surface like marble. There are other textures which do better. By the way, is it true that our Government could not afford to dress its fine library in as good stuffs as Charles II. dressed himself in? Must the Government put scarlet garters on the library as Mr. Pepys did upon his clothes? The Government employed Mr. Macmonnies to sculpture the stairway, and he did some work that makes us happy. If one would ask for more stately dignity in these sculptures, it may be answered that it is not well to question an art that is as true and good as that of Macmonnies. His talent runs to the sprightly, and it is a true, a real talent. Let us be thankful and content. Possibly the jolly figures — a bit flamboyant — are exactly in the spirit of the times, and if that be true do not try to saddle Greek formalism upon the nineteenth century. All these painted panels also show the peculiar spirit of the artists who made them, as they should. There are some better than others, but all are so good that criticism is disarmed.

Just a word about this painted decoration at Washington. What is said here is this: It is not a success as painting. The colors are too violent in any case and much too crude to stand in connection with the soft white of marble. Possibly better-guided workmen could have secured a better result. The artists' panels go with the surroundings well enough (though one questions even the panels), it is the conventional patterns that cry out because they are crude and because they are painty. It is the purpose here to declare that paint and marble is a difficult combination — possibly an impossible one. The divorce-court judge would have his sympathies so appealed to in this case of incompatibility that he would stretch the law in his effort to grant a decree. The mosaics in the lower vaults are perfectly in accord with the marble and can live with it until death do them part. Glass mosaic, as seen in the Chicago library, relieves wonderfully the frosty marble. The stair is quite uniform in whiteness while the blank walls are varied by dextrous minglings of various shades of marble. Not to express any opinion of my own, I may repeat those of many lay-people. The laymen complain on account of the sharpness of line in the stair mosaics, but do not find fault with the under-arches or the panels. The reason is easy to find — the panels and arches are just as brilliant, but in larger masses, and, therefore, less violent in effect. They do not declare war. But the "quality" of the two materials is the same and they walk hand-in-hand, neither one insults the other. The bronze is also a brother, and the fine stained glass in the dome keeps up the family aristocracy. The walls and mosaic are by a New York firm, but the glass is, I am told, a Chicago product. Certainly this glass is excellent, and we have firms here that could do the mosaic as well as the glass is done.

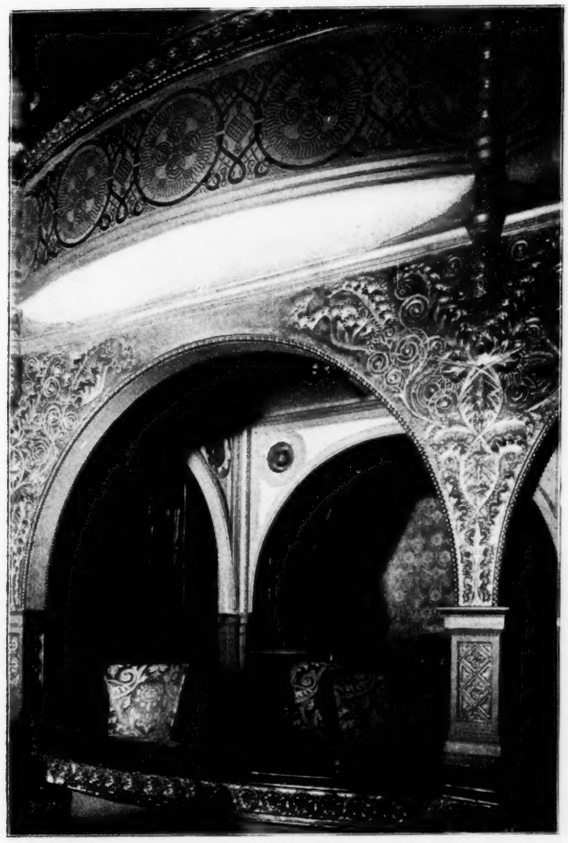
There is excellent bronzework here and it proves itself of the same "quality" as the marble, the mosaic and the glass. Possibly our fine cast iron, bronzed, might come into this family.



DECORATION, PROSCENIUM ARCH, AUDITORIUM, CHICAGO.
Adler & Sullivan, Architects.

If we keep on making sharp castings, this art will claim a right to shake hands with prince bronze. It is an imitation, but perhaps good enough to claim its rights as an original. Good cast iron is good enough.

To return to glass again. That we Americans have invented a new kind of glass decoration nobody can deny. The use of



DECORATION OF BOXES, AUDITORIUM, CHICAGO.
Adler & Sullivan, Architects.

new methods in any line is noteworthy, that our inventions should take an artistic bent is matter for congratulation because we are called scientific but not artistic. The new tones of glass that we have invented, the ingenious and beautiful combinations we make of them, the results of glass overlays and all the novel effects attempted, are matters which wake up our ancient teachers over the water. All this glass, however, must have its appropriate companionship. It is a material of all others elegant and needs princely neighbors. Painted stucco is shamed by it. Fine stone-work, bronze or gold or the best of choice woods are its proper society. There are some "enamel" paints that may claim comradeship also.

I know a church in Belgium—if memory serves right it is in Charleroi—where there is an interior richly supplied with the best of colored glass windows and also it is elaborately painted. It was reputed to be a refutation of the theory that colored glass could not be used with a painted interior. A visit to this church revealed worthy workmanship in both these mediums and the effect was not to be despised, but the painting was badly abused by its richer competitor and the theory was not disproved at all. Painted decoration, however good, had better keep away from good colored glass. If the Board of Trade ceiling could be given a "tubbing" oftener than once in seven years (or longer) we might judge of the matter right here in Chicago. As it is now, no one can tell by that hall. It is in glass and mosaic work that we have a success and that we do good things, and these combined with marble (which is better white or nearly so), gold, bronze or fine woods are the materials best suited to our soft-coal climate.

Other articles:

Moresque, *Inland Arch.*, Vol. III, No. 1. Walls and Ceilings, *Inland Arch.*, Vol. IV, p. 37. Interior Decoration, *Inland Arch.*, Vol. VII, p. 27. Mosaics, *Inland Arch.*, Vol. XI, p. 64.

RELATION OF THE ENGINEER TO ARCHITECTURE.

FORMERLY the architect was his own engineer, and not always a good one. This branch is not sufficiently emphasized in the architect's education, and some of the best architects call in the engineer when it comes to the practical work of engineering construction. The present tendency is toward a separation of the professions, the architect keeping strictly within the limits of his special training, and the engineer sticking closely to his figures. Yet there are not a few of the fraternity who believe that engineering is quite as properly a part of an architect's education as is drafting, and that the future will see some important additions to the curriculum in this respect in this country.

In the German technical schools they manage this matter quite differently. The architect is an engineer as well as a designer. He knows the strength of materials and the value of logarithms as thoroughly as his brother of the engineering school. He is not allowed to practice his profession without passing a rigid examination in the ordinary branches of an engineer's training. The result is that he becomes at the outset of his career an all-around man. Whether that fact tends to make him more or less successful as an architect we leave to the judgment of others. There is an opinion abroad that no man can have a too thorough training for his calling, and the tendency is toward enlarged rather than reduced courses in all the schools.

At least two instances of prominent Chicago architects who entered on a professional career as engineers might be adduced in this connection. These men found the drawing toward the artistic to be more powerful than the prosy pursuit of the practical, and they forsook engineering for architecture. Both have made noteworthy successes along the latter line, but both have been distinguished quite as much for their engineering as for their architectural skill. One is well known as the inventor of the steel-frame method of high-building construction, and the other is noted for his proven ability in solving great architectural problems where difficult engineering feats are prime factors. With both of these men the architect is great because he was preëminently an engineer.

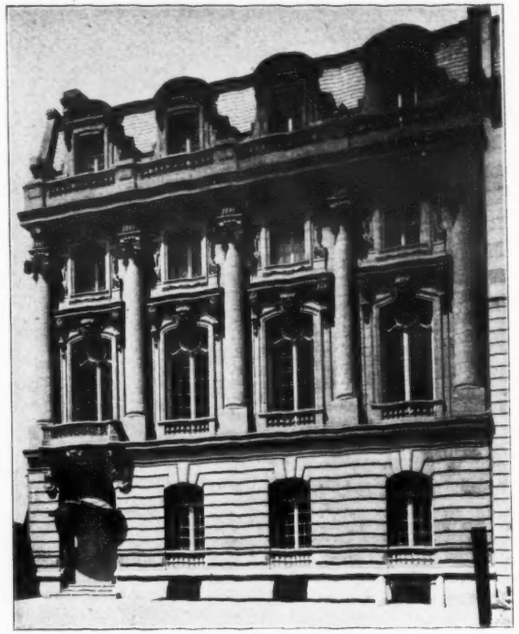
Yet the average architect often fails to combine the two spheres of action successfully. The architect is essentially a planner, a seeker after a combination of utility and beauty—the best possible arrangement of an office building commercially considered, together with a pleasing exterior and a rich and impressive interior. He can not always devote the needful time to the securing of all this, and at the same time immerse himself in the mass of figures and measurements that are essential to a safe and economical construction of the building from an engineering standpoint. So he associates with him in his work a practical engineer, evidently believing with our gallant Schley that "there is glory enough for all."

From foundation to roof the engineer must stand over the work almost literally day and night, rule and pencil in hand, to make sure that the eternal laws of physics are not violated, and that the mighty building shall not have been built in vain. His is a labor of vital importance.

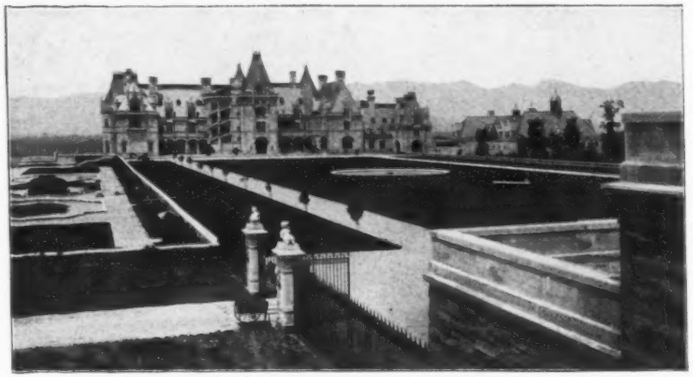
THE PLACE OF THE GENERAL CONTRACTOR.

ARCHITECT, engineer, superintendent and contractor—all are involved in the question, Shall the contract be let entire or in detail? The old plan, to parcel the work out to each of the several contractors and to manage them all from the architect's office through the medium of an active superintendent, is still adhered to faithfully by some architects in all their work, as they claim that they can get better results by giving their personal attention to each contract, but some of the architects of large work believe this plan has its limitations, and that while it may be all right for smaller buildings, like residences, it is not to be recommended for larger enterprises.

When an office building, or a large factory or warehouse, or a great flat building, is to be erected, this question becomes of prime importance, and it is then that the general contractor appears on the scene as a mediator between architect and workman whose value is recognized. He takes the contract entire

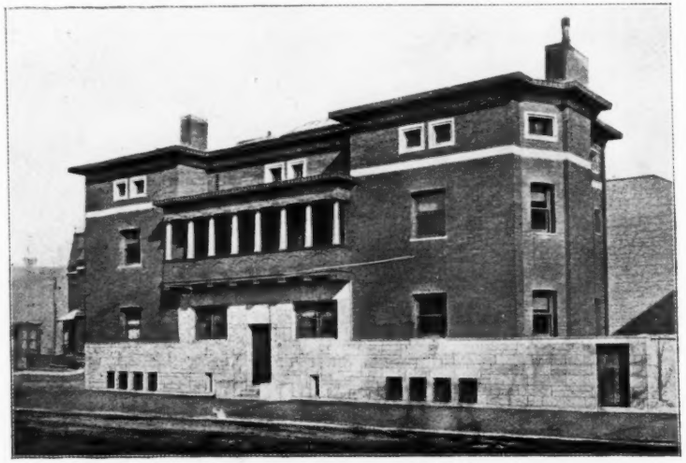


AT NEW YORK CITY.
Carrere & Hastings, Architects.

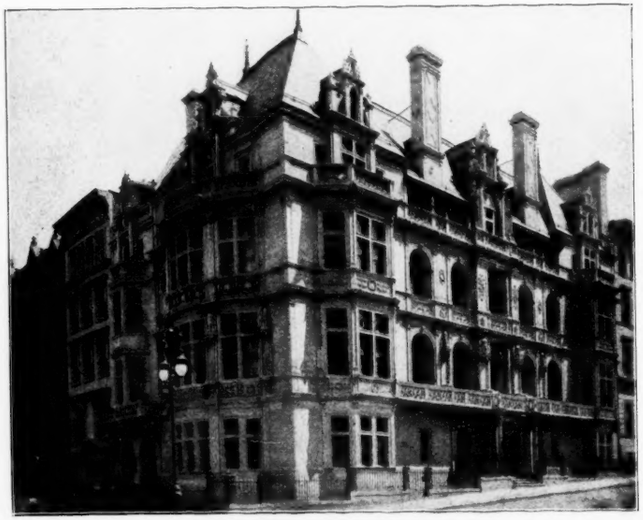


BILTMORE HOUSE, ASHEVILLE, N. C.—Richard M. Hunt, Architect.

AT WASHINGTON, D. C.
H. H. Richardson, Architect.



AT CHICAGO.—Adler & Sullivan, Architects.



AT NEW YORK CITY.
Kimball & Thompson, Architects.

AT SPRINGFIELD, MASS.—Bruce Price, Architect.

AT NEW YORK CITY.
McKim, Mead & White, Architects.

A GROUP OF RESIDENCES.

and is responsible for every detail of it. He gives ample bonds for the whole work, and shoulders the responsibility which otherwise would be divided up among two dozen or more smaller and perhaps less responsible contractors. If he is an enterprising and up-to-date contractor he employs a superintendent who is a practical engineer and who takes upon himself almost all the load of providing the proper material whenever needed; guarding against delays by keeping the several contractors moving in their regular order, one moving out of the way of another; inspecting and regulating the work from the standpoint of an engineer quite as much as of a superintendent. Such a man is valuable in smoothing over rough places in the busy architect's life and in reflecting credit on his employer, the general contractor.

VARNISH—ITS USE AS A FLOOR FINISH.

BY EUGENE M. POPE.

VARNISH-MAKING as an art was known to the ancients, and with them attained to some degree of perfection. It was practiced by the citizens of Pompeii and Herculaneum before the destruction of those cities, as is attested by the finding there of articles coated with varnish. It has been practiced also by the Chinese and the inhabitants of the East Indies from time immemorial. But only in the present century has it been brought to the highest degree of perfection, and this is due in large measure to the enterprise of American manufacturers.

The prime requisites of a good varnish are said to be four in number, as follows: It must dry rapidly and hard; it must retain enough elasticity when thoroughly dry to prevent cracking; it must preserve a smooth, even and hard surface; and it must adhere tenaciously to the material on which it is spread. These qualities are commonly attributed to the varnish itself, but they are quite as dependent upon the proper selection and application of the varnish by the workman. Varnishes are now made specially for all kinds and conditions of work, and they must be selected carefully, with reference to the particular requirements in hand. The surface to be covered must be carefully prepared also. Then the varnish may be applied with skill and care, and the work, if done well, will be enduring. But too often the work is not done well.

So great a variety of gums, dissolved either in spirits or oils, are used in the manufacture of varnishes that it is not possible for the architect or contractor to judge of the merits of a varnish by its name or its constituents, even though he were able to ascertain the latter; the usual and the better plan is to rely upon some responsible varnish manufacturer and to call him severely to account for failure, if any, of his goods to give the promised satisfaction. In general, it may be said that the use of common "resin" in the manufacture is likely to produce a varnish that will perish quickly—in other words, a cheap and undesirable product.

The most recent, and perhaps the most important application of varnish to architectural work is in the finishing of hardwood floors, the varnish used for this purpose being known as "Supremis Floor Finish." Almost from time immemorial the only finish known for a hardwood floor has been wax; in Europe no other is used, but in America a new departure has been made, and varnish is now considered the floor finish *par excellence*. Sixteen years ago this material was unknown in the architectural world; it is now universally known and used, and the only seeming drawback to its use is the supposed difficulty in removing the old wax finish from the floors. Methods of doing this are now in vogue and enable any one to perfectly remove all wax and to fit any floor for application of varnish.

The floor to be varnished must be thoroughly cleaned and then well filled, if a porous wood; but if a close-grained wood is used, the varnish must be directly applied, without the intervention of any other material whatever. Experience has shown that a varnish finish will wear better on floors, even on porous wood, without the use of any filler, the varnish being applied directly upon the wood; but there is some objection to this method on open-grain woods, in that the finish sinks into the pores and does not show so even a surface as appears when the wood is well filled. The durability of the finish, however, is greater when no filler is used.

The variety of ordinary uses to which varnish is applied, for interior and exterior finish, is familiar to the architectural world. It is coming into more and more general use as its advantages become better known. Its economy lies in the fact that it is so excellent a preservative of the work which it covers, and the secret of success in using it is in the care with which it is applied. Varnish is not a cheap material and should not be cheaply used. It should be applied intelligently and carefully, with special attention to the previous preparation of the wood, and when so handled it will give satisfaction.

FINE ART IN HOUSE PAINTING.

HOUSE painting has become in these latter days a fine art. The modern painter has need of knowledge and skill that his ancestors never dreamed of. The requirements of the architectural world and of the trade itself are growing in importance constantly and call for constant vigilance and enterprise on the part of the manufacturer. The time when a painter could succeed with the equipment of a few brushes and the ability to daub paint on a board has passed away forever. It has gone with the era of rough and ready manufacture, when spurious goods passed for genuine, and the paintmaker followed the old ruts because he did not know any better.

The average paint shop, however, is no longer a paint factory, for the painter is now content to leave the important matter of ingredients to the manufacturer, and he relies upon the latter to supply him with every variety of compounds for use in the trade. Beginning with wood fillers this variety runs the entire gamut of the painter's scale, including dry and water stains, surfacers, oil stains, japans, enamels, varnish removers, stain and paint removers, mixed paint, floor paint, roof, barn and bridge paint, bronzes, dry colors, white lead and oil—everything, in fact, the mere mention of all of which would be too much for our space. Even kalsomine is now sold ready mixed and is said to be better and cheaper than the painter-made variety. It is an age of short cuts, in this art as in all others.

The perfection of the art is seen in the manufacture of wood fillers and stains for furniture and interior finish. A good filler must fill thoroughly, dry very hard, rub off easily, be uniform in color, not given to settling, and as a result of these qualities will produce the very highest grade of work. Especially important is the clear, rich, uniform shade produced by the imported colors. A filler of this character has been brought out under the name of "Silex." Shellac has long been used for this purpose, but "Silex" is said to be superior to shellac and is cheaper. It costs less, works easier, covers better, costs less to thin, does not settle, brings out the color of the wood, dries dustproof immediately, and hardens perfectly, is easily sandpapered, and the manufacturers claim that it holds the varnish up better than anything else.

Another similar mixture is known as "Silaxer," which is a hard-drying surfacer, and is used as a liquid wood filler for close-grained wood and in place of shellac over a paste filler on hardwood, making a nonporous and perfect foundation for a finishing coat of varnish. "Silaxer" dries flat and will sandpaper without gumming; it may be used on fine work, as it contains no resin and will not crack varnish used over it. When desired, a stain is combined with the Silaxer, which is an economy both of stain and of the labor of applying it.

THE CENTURY'S TRIUMPH IN LIGHTING.

MODERN architecture is fundamentally utilitarian and commercial, admitting of only such an amount of ornamentation and relief as can be introduced without interfering with its particular purpose. The demand for light, for example, is one which pertains to commercial and residence architecture alike, and this demand has been met heretofore by artificial means almost entirely. With the introduction of windows came the use first of isinglass, paper, sea shells and other similar substances for window panes. Then came glass—not clear and translucent, but rough and cloudy; but the march of improvement has been steady, until at the present day it is as clear as crystal, admitting the bright sunlight almost perfectly.

So success breeds success, and one achievement leads to another. The same qualities of intellect and enterprise that accomplish one really notable deed are able to work out something still greater. It is this progression of events, all tending in one direction, that characterizes modern scientific or commercial enterprises when brilliantly successful. More daylight! more daylight! is the cry—from the man at the desk, from the salesman, from the great business-houses that have goods to show. And the cry goes on—away with artificial light as a substitute for daylight! away with dark rooms and offices on alleys and courts! And that same tireless brain of science says, here it is, and keeps on advancing until progress and science place in our hands the means of giving to the world just what it wants—more daylight. It is the Luxfer prism—word well chosen—*Lux*, light; *ferre*, to bear—light-bearing.

The far-sighted inventors of the Luxfer prism saw that if daylight could be thrown into dark places, and thus save the expense and annoyance of artificial light, it would be one of the most important architectural achievements of the century. Accordingly, they produced a small square of prismatic glass which was found to increase the light in dark interiors from two to ten fold. This apparently insignificant little piece of glass has become famous the world over, in the short space of

AT NEW YORK CITY.
McKim, Mead & White, Architects.
AT SPRINGFIELD, MASS.—Bruce Price, Architect.
A GROUP OF RESIDENCES.
AT NEW YORK CITY.
Kimball & Thompson, Architects.

two years, as the Luxfer prism, and has opened up for itself a very wide and important field of usefulness. Every day suggests new possibilities for the prism, and hardly a week passes but some new adaptation of the glass is put to the test.

One of the first problems presented for solution was the lighting of dark basements. It was found that when prisms were placed in the sidewalk they lighted the front of the basement only. A vertical prism was then placed in the basement windows to gather up the rays of light from the sidewalk prisms, and project them to the farther end of the basement. This device, called the "Lucidux," was satisfactory, and at once it became possible in this way to make the darkest basement as light as day. No comment is needed on the possibilities thus opened up in the way of utilizing formerly dark and useless basements. In thousands of instances the Luxfer prisms may be so applied as to actually reclaim this otherwise waste space in important business structures.

Similarly in narrow streets or alleys, or in the lowest stories of light courts, where an insufficient exposure to the direct rays of light on vertical windows is had, the same principle is resorted to. A canopy of ornamental iron and prisms is projected above the window. The light, falling almost vertically, is caught on the canopy and thrown back into the room. Sometimes it is found desirable to use a "forilux," or vertical prism plate, projected a few inches in front of the window. The canopy, forilux and lucidux solve every problem of difficult lighting caused by overshadowing buildings or long and dark interiors.

Perfection of mechanical detail has been secured in the joining of the numerous small prisms that make up a single window, by the rapid electrolysis process, by which the small sections are first fitted into grooves in narrow strips of copper ribbon, the entire frame being then submitted to the rapid electrolysis process, which deposits more copper and fills up every crevice, making of the whole one solid piece. This construction admits of the maximum of strength and lightness, and is especially fitted for stained-glass work. It has been found to be fireproof also, and possesses far greater resistance to breakage than a single sheet of heavy plate glass. The importance of this fireproof quality can hardly be exaggerated. By this construction the most vulnerable portion of a building —the window—may be made proof against the ravages of fire. The dangerous and unsightly light shafts also may be dispensed with, as was done recently in the J. P. Ryerson building, in New York city, where a room 204 feet deep was perfectly lighted by Luxfer prisms placed in front and rear.

A more remarkable achievement was that of lighting the subcellar of the Metropolitan Life Insurance Company's new building in New York. This subcellar is twenty feet below the street level, yet by the introduction of the Luxfer prisms it is lighted perfectly, and the light so thoroughly diffused that no shadows are cast by the supporting columns. It is but one of many demonstrations of the wonderful possibilities in daylight lighting by use of the Luxfer prisms.

HOUSE MOVING AND SHORING.

HOUSE moving has been reduced to a science; the science of moving the largest and heaviest and most heterogeneous buildings in existence. Formerly it was thought that only some old tumble-down frame structure that had become a disgrace to the neighborhood was fit subject for removal, but now the better the house the better the deed, and no task, however complicated, is considered impossible. It might not be too improbable to believe that he who performed the gigantic task of moving a 6,650-ton church fifty feet down the boulevard, and raised it five feet and six inches, could remove the Great Pyramid from its present location to Chicago, to grace the next World's Fair, if a steamship large enough to carry it could be had.

The modus operandi of moving a monster building is somewhat as follows, the example taken being the church above mentioned: The walls were first thoroughly braced to prevent spreading. The load was raised on screws, and a track of steel rails resting on a floor of 12 by 12 inch timbers was laid under the building. The timbers covered the entire ground, and the rails (60-pound steel) were distributed three to five on a track with reference to the load to be carried. On these rails steel rollers were used, each 25 inches long and 2 inches in diameter. The upper surface of the rollers moved on Bessemer steel linings, ½ inch thick by 12 inches wide, cut in 2-foot lengths. Heavy timbers, inserted through openings in the foundation, supported the building on the rollers.

The problem of propelling the building along the tracks was solved by applying jack-screws to the beams on which the structure rested; the screws pushing against other similar beams which were held fast by heavy chains. Sixty screws were used, and each quarter turn of the screws (made simultaneously) advanced the building about one-eighth of an inch. This immense task of church moving is usually referred to whenever moving possibilities are discussed, but essentially the same principles are being employed in other everyday contracts of this kind. For example, a courthouse of brick and stone, 90 by 124 feet in size and with walls 4 feet thick, is being raised 11 feet to receive a new foundation. Another instance is that of a building, in which it was desired to reconstruct the interior and also the exterior up to the second floor. The entire building was shored up throughout, from bottom to top, and all posts, girders, etc., removed, all foundations rebuilt and new iron columns and steel girders put in place, the work being finished in the record-breaking time of twenty-one days.

A CONSIDERATION OF THE GAS QUESTION.

FROM time immemorial (i. e., gas time) gas meters have not been properly provided for in building planning. Frequently, if any provision at all has been made for them, it has been in a remote corner—usually in the basement—where their environment was spider webs, dust and rust, and their faithful "click" was lost to hearing on the murky air. Now a change is demanded. The gas companies have decreed it, and what the gas companies want they generally get. They insist that the gas meter is a legitimate part of the modern architectural scheme, and that it deserves a comfortable and accessible place in every building where gas is used. Accordingly, they ask architects to give due attention to this feature in future plans, and to add thereby to the sum total of happiness both of the meter man and the consumer.

Another and equally important reform is that demanded by Chicago gas inspectors relating to the location of shut-off cocks in buildings. The present custom often is to locate these valves at some distance within the building, where they are not readily accessible in case of fire. The result has been disastrous in many instances, many lives having been lost through gas explosions which might have been prevented had it been possible to shut off the gas from burning buildings. The new plan is to locate the shut-off valve outside the building, near the curb, and to cover it with plate glass, which may readily be broken by the firemen in case it becomes necessary to disconnect the mains from the house on short notice.

BUILDING SPECIALTIES.

THE MODERN ORNAMENTAL REGISTER.

Time has been when the register was, of all things architectural, the least ornamental, and was regarded as a sort of necessary evil and tolerated rather than welcomed by the architect who had a keen eye for the beautiful. This has all been changed in modern practice, the register of today being a very different article from its progenitor. It not only answers the purpose of heat or ventilation, to which it may be adapted, but is really an ornament as well, and is seriously considered in the general scheme of construction with a view to elegance and harmony. In other words, the register is capable of design and decoration in the highest degree.

This change has been brought about by enterprising manufacturers in two directions, namely, material and treatment. The ordinary cast-iron register labored under the disadvantage of being necessarily made of cumbersome castings to obtain the requisite volume of air capacity, and lacked the essential qualities of lightness, strength and beauty of design; hence a new and stronger metal was necessary to produce the desired results, and the ingenuity of American manufacturers proved equal to the occasion.

A practically new metal was evolved—a construction of iron and steel known as "Ferrosteel"—by the use of which was obtained the long-coveted advantages of increased air capacity of from ten to twenty per cent over ordinary cast-iron registers, lighter castings, greater strength by twenty to twenty-five per cent, and capacity for delicate and ornamental designs; so that now, when the architect wants his registers to conform to his own special designs he may have them, and they may be his exclusively if he so desires.

"Ferrosteel" produces castings of uniform smoothness, thereby permitting finishes of a new and varied character, such as electroplating in any desired color to harmonize with the varied finishes of hardware and decorations, in addition to the finishes with which the architect is familiar. Therefore, registers, ventilators, pedestal registers and screens made by the new process fulfill the most painstaking consideration of the architect in his designs for interior arrangement and decorations.

CHANGES IN THE LUMBER SUPPLY.

Hardwood interiors are likely to possess a rare value in the near future if the present scarcity of hardwoods continues.

Northern-grown hardwood is said to be rapidly disappearing, and the trade will soon be dependent almost wholly on southern forests for the supply. This applies particularly to red oak and white oak, maple, elm, basswood and birch, which have heretofore been found in large abundance in Wisconsin and other northern States. The scarcity has become so pronounced and prices have risen so much in consequence of it that several northern lumber firms have relocated in the South, where they find an abundance of red and white oak, satin walnut, cypress, poplar, sycamore, etc. This southward movement of the source of supply is one of the most significant factors in the present situation. Another is the successful competition of the Pacific coast forests with the East. Although 12,000 miles distant by water, they are sending fine lumber for interior finish by sailing vessel all the way "around the Horn," and selling the cargoes in Philadelphia in competition with eastern-grown lumber. Pine grown in the great lumber regions of the far Northwest is of a closer grain and admits of a finer polish than Southern or Eastern pine, and is of great durability. It is resawn in the forests of Columbia and Oregon, and shipped from there to Victoria, the nearest seaport. The Delaware river shipbuilders, who have contracts to finish the saloons of vessels with woods of high polish, and the builders of dwellings in which the same woods are extensively used, have been unable to find what they wanted anywhere in the East, and are compelled to look to the forests of the South and the far Northwest for their future supply.

In general, the lumber trade situation at present is one of great activity and rising prices, following a long period of dullness and depression heretofore unexampled.

THE ECONOMY OF PROMPT SIGNALING.

Economy in the operation of elevators in large buildings is as desirable as a good equipment. When cars are carelessly run, the service may cost double as much as it ought, and at the same time may be entirely unsatisfactory, both to the owner and the public. To insure absolute certainty in the making of stops is a most difficult task, since even with the best of numeral indicators passengers will neglect to call their floors in due time, with the consequence that the elevator passes the floor, and is compelled to stop and return, at an expense of time and power, which if repeated hundreds of times a day, is very costly. To simplify all this running, and to avoid this useless expense, the system of electric light signals has been devised and brought to perfection.

The general plan of this system is that of the electric light in both car and hall, giving warning to the passenger that a car is approaching, and to the conductor that the passenger awaits him; but there are several features of the perfected system.

At each floor landing two ordinary push contact buttons are neatly mounted on an ornamental block. These buttons are marked "up" and "down," and are normally open. The car signal consists of a small colored incandescent lamp, inclosed in an opalescent globe and ornamental holder. This lamp is illuminated when the car approaches within one floor of the one on which the operated button is located, and is automatically extinguished shortly after the car has left the floor. These features are adjustable. Should it be inconvenient to stop on receipt of this signal, the operator may push the normally closed circuit button, which prevents the operation of the signal for that particular car, but leaves the other intact. The next approaching car, however, will receive the signal.

On the landings before each elevator shaft are placed lights which indicate whether that particular car is going up or down. These lights are operated similarly to those in the cars, and give ample warning to the passenger as to which one of several cars will first reach his landing. In this system the signal to the car conductor is received only in the nearest up or down car approaching the landing at which the button has been operated. This avoids all possibility of confusion arising from several cars receiving the same signal.

NEW USES FOR GALVANIZED IRON.

New adaptations of galvanized iron are met with every day. Not the least of its advantages is that it is fireproof, and wherever it can be substituted for wood in construction it insures fireproof qualities in the building. With this end in view iron shutters were formerly used, and are still required under some conditions. Wired glass has been substituted and has been found to prevent effectually the spread of flames when interposed. But wired glass set in a wooden sash and surrounded by a wooden frame can not be regarded as the ideal fireproof window construction. Something more is needed, and is supplied in the latest adaptation of galvanized iron to architectural uses, namely, the iron window frame and sash.

The writer recently saw in a well-known Chicago factory what seemed to him to be a revelation of the useful qualities of galvanized iron as never before thought of. A complete window frame of the iron, with sash made of iron strips and glazed with wired glass, was the most effectual barrier to the spread of fire through an ordinary window that we had ever seen. The frame was adapted to be set in an arch of masonry, exactly as the wooden frame is set. It had all the good qualities of the wooden frame and was more enduring and absolutely noncombustible. The glass was held in place in the sash by means of iron strips; putty could be used but was not necessary. The wired glass was not transparent, but we were informed that a clear quality is now about to be put upon the market and that a transparent fireproof window is a certainty in the near future. The arrangement of the window stops was an ingenious reversal of the usual order, the sash being grooved, and the stop, consisting of a tenon, fitted closely to the inside of the frame. By the removal of the lower half of this tenon, which can be done instantly, the entire sash can be quickly taken out of the frame for cleaning or repairing. Altogether it was a most ingenious adaptation of galvanized-iron work to window construction.

AN INGENIOUS WINDOW-WASHING DEVICE.

The "bracket-rod" system of swinging windows is an innovation in window-cleaning practices that has come to stay. It all depends upon what is known as the "bracket rod," which is a hinged portable rod applied to the sash to be swung. This is practically all that is seen in operating the window. It is an ornamental fixture and is removed from the casing when the sash is returned to its normal position, so that the only parts that show are the small-headed studs, which are hardly noticeable.

The advantage of this device lies in the fact that it can be applied to old and new windows alike, without altering them materially, and at comparatively small expense. One pair of the bracket rods is usually sufficient for an entire building. Any style of window can be arranged to swing on them, and any size or weight of sash can be controlled by the rods by selecting a rod sufficiently heavy for the weight to be carried. It was somewhat of a novelty to see new and old windows, transoms and large stationary windows changed almost instantly into swinging windows and opened inward with perfect ease by applying the little bracketed rod to studs on sash and frame.

INVENTION APPLIED TO DETAILS IN HARDWARE.

A practical difficulty which is not uncommon in warehouses, where large openings require large doors and the side space is not sufficient to permit of sliding doors, has been overcome by a very ingenious invention which throws the door inward and upward to the ceiling, holding it there firmly and yet so evenly balanced as to permit of being easily brought down to earth again. No matter how heavy the door may be, it can be readily handled by one hand. As the lower edge of the door moves upward in the side grooves, the upper edge moves inward along the ceiling on side tracks, set at an angle of about twenty-five degrees, until the entire door rests, as it were, like a fly on the ceiling. To see an 800-pound door disappear in this way is somewhat startling. It looks as if the operator suddenly seized it and tossed it upward out of the way.

An all-steel, ball-bearing barn-door hanger is one of the latest improvements. It has hardened steel bearings, and twenty-two ¼-inch balls, and will hold any door weighing up to 500 pounds. This is a great improvement over the old style of wheel hangers. A similar device has been applied to show cases; it is known as the ball-bearing show-case door sheave, and is so arranged that the balls run directly on the track. It runs smoothly and does not wear out.

LATEST IMPROVEMENTS IN ROOFING FELT.

It was a novel but happy thought that brought out the screened gravel roofing, the idea underlying it being that a roofing felt having the gravel already in place would be a great economy of time, labor and material, and would give far better satisfaction than the old method of applying the felt first and then coating it with tar and gravel. This has proved to be the case in actual practice. This material is made up of a base of 15-pound asphalt felt, on which are placed two layers of Trinidad asphalt with burlap between, the whole being covered with screened gravel and then compressed between rollers to three-fourths the original thickness. The finished product is a heavy, solid and durable material for roofing purposes on either flat or pitched roofs, and which costs less for labor or material than the ordinary roofing.

Wherever an asphalt felt can be used, it is a most desirable roofing material, provided it is first-class asphalt. Its durability, lightness, nonconducting qualities, and, when gravel-coated, its fireproof character, are all well known and appreciated by the building fraternity.

LUXFER PRISMS

PAY 25% TO 50%

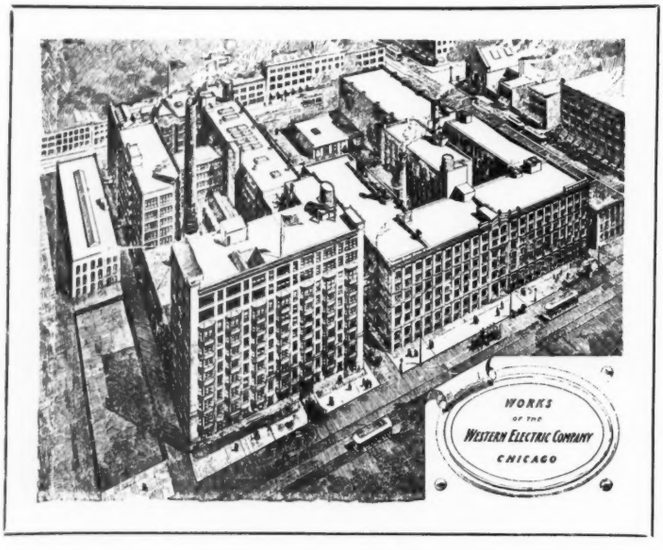
On Their Cost Each Year.

During DAYTIME Live in DAYLIGHT.

AMERICAN LUXFER PRISM CO.
372-380 Fulton Street,
CHICAGO.

Contractors for Electrical Installations

...OF ALL DESCRIPTIONS...



MANUFACTURERS AND DEALERS

Electric Light and Power Apparatus,
Arc and Incandescent Lamps,
Wire, Cable,
Batteries, Bells,
Annunciators,
Fan Motors,
Telegraph, Testing and
Measuring Instruments,
Switchboards for Light
and Power Circuits,
Switches, Sockets,
Cut-Outs and Electrical Supplies.

WESTERN ELECTRIC COMPANY,

CHICAGO...NEW YORK.

LONDON,
70 Coleman Street, E. C., and North Woolwich, E.

ANTWERP.
33 Rue Boudewyns.

PARIS.
46 Avenue de Breteuil.

DAVIS MOSAIC CO.

SUCCESSORS TO

FRANK L. DAVIS

MARBLE GLASS CERAMIC **MOSAICS** FLOORS WALLS CEILINGS

302 MICHIGAN AV. **CHICAGO.**

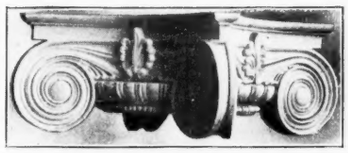
SPIERLING & LINDEN

..Decorators..

Estimates and sketches submitted for complete furnishings.

1216 Michigan Avenue . CHICAGO.

TELEPHONE, SOUTH 94.



The Decorators Supply Co.

CHICAGO, ILL.

Ornamental Relief Work.

Beil & Mauch

Architectural Sculptors..

81 Illinois Street
CHICAGO

Designing. Modeling. *Stone and Wood Carving. Ornamental Plaster.*

JOSEPH DUX

Architectural Sculptor

278-280 E. Madison St.

Telephone, Main 2545. CHICAGO.

NORTHWESTERN TERRA COTTA CO.

WORKS AND OFFICE:
Clybourn and Wrightwood Avenues
Branch Office: 1118 Rookery Building

CHICAGO.

The American Terra Cotta and Ceramic Company

CHICAGO

The James H. Rice Company

34-40 SOUTH WATER ST.
CHICAGO.

GLASS **Plate and Window Glass**

Mirrors, Art, Beveled and all fancy glasses.

ESTIMATES FURNISHED PROMPTLY.

Adams & Elting Co.

MANUFACTURERS OF

WOOD FILLER, STAINS, BRUSHES, COLORS, ASBESTINE SHINGLE STAINS, ENAMELS, WHITE LEAD AND WOOD AND IRON FINISHERS' SUPPLIES.

155 & 157 W. Washington Street, CHICAGO.

Heat Regulators

Johnson Temperature Controlling Co.

411 Dearborn Street, CHICAGO.

For News of Building, Latest Improvements in Materials, etc.,

...READ...

The Chicago Times-Herald

THE LEADING MORNING DAILY.

25,000

Telephones in Service.

Connecting with entire country by toll and long-distance lines. Unlimited or measured service at low rates.

Chicago Telephone Co.

Chicago Title and Trust Co.

Offices on the Main Floor of its Building.

100 WASHINGTON ST.
CHICAGO.

Insures title to real estate.
Makes abstracts of title.
Takes title to real estate for syndicates.
Executes trusts under the supervision of the State of Illinois.

TELEPHONE, 934 CENTRAL.

CONTRACTORS, DEALERS, MANUFACTURERS

ELECTRICAL APPARATUS AND SUPPLIES.

Western Electric Company

CHICAGO NEW YORK
LONDON,
79 Coleman Street, E. C., and North Woolwich, E.
ANTWERP, 33 Rue Boudewyns.
PARIS, 46 Avenue de Breteuil.

JOHN MOHR, PREST. LOUIS MOHR, SEC'Y. JOSEPH MOHR, TREAS.

John Mohr & Sons

..BOILER MAKERS..

32 to 42 Illinois Street,

Address All Correspondence to our Chicago Office, 32-42 Illinois Street.

E. C. & R. M. Shankland

CIVIL ENGINEERS

816 The Rookery,
CHICAGO.

W. L. STEBBINGS,

Consulting Engineer,

1118 MONADNOCK,
CHICAGO

W. MORAVA,

Consulting Engineer

1243 Marquette Building,
CHICAGO.

E. SALICH & CO.

Consulting Engineers

Experts on Construction
Sugar Beet Plants

802 Monadnock Block
CHICAGO, ILL.

S. G. Artingstall,

Civil and
Consulting Engineer,

240 Rialto Building,
CHICAGO.

Wm. S. MacHarg,

Consulting Engineer

Room 201 City Hall,
CHICAGO.

MEACHAM & WRIGHT,

MANUFACTURERS' AGENTS FOR

Utica Hydraulic Cement

AND DEALERS IN

IMPORTED AND AMERICAN PORTLAND CEMENT, MICHIGAN AND NEW YORK STUCCO.

308-309 Chamber of Commerce Bldg.....CHICAGO
TELEPHONE EXP. 59.

DICKINSON CEMENT CO.

DISTRIBUTORS....

ALPHA
BRONSON
MARQUETTE

Marquette Building ..... CHICAGO

Established 1869.

SIMPSON BROS. CO.

Chamber of Commerce,
CHICAGO.

Concrete Construction

FOUNDATIONS AND ABUTMENTS.

Rock Asphalt Floors and Pavements,
Concrete Curb and Gutter,
WALKS, DRIVEWAYS AND FLOORS.

FRANK SEARS. WM. S. HUMBERT. C. B. SEARS.

Sears, Humbert & Co.,

Successors to JAMES BRAND.

Western Sales Agents THE AMERICAN CEMENT CO.

U. S. Agents...LaFarge, Josson, Burham, Schifferdecker, Gristower....Foreign Cements.
"Giant" Portland, Union Rosendale, Egypt Portland, Improved Union.

OFFICE: 34-36 CLARK ST.,
CHICAGO.

BUFFALO: 434-436 GUARANTY BLDG.
NEW YORK: 81-83 FULTON STREET

The Garden City Sand Co.

"CHICAGO AA,"
"LEHIGH,"
"VULCANITE" and "STAR"
Portland Cement.

"WIGTON STEEL,"
"FRANKLIN CROWN,"
"SLIGO" and "DOME"
Fire Brick.

The Garden City Sand Co.,
Tel. 5102 Main. Security Building, Chicago.

Established 1866.

STAMSEN & BLOME,

HEAVY

Concrete Construction

EVERY BRANCH OF PORTLAND CEMENT PAVING.

SECOND FLOOR UNITY BUILDING,
CHICAGO.

ERNST HELDMAIER, Pres. HENRY FURST, Treas.
GEO. TAPPER, Vice-Pres. E. T. MALONE, Sec'y.

TELEPHONE, MAIN 3336.

The Portage Entry Quarries Company

Portage Red Sand Stone
Presque Isle Brown Stone
Marquette Rain Drop

GENERAL OFFICES:
9th Floor Security Bldg., CHICAGO

A. Kieckhefer Elevator Co.

Elevators

Milwaukee,
Wis.

People's Gas Light & Coke Co.

CHICAGO.

EDMUNDS MFG. CO.

Interior Woodwork.

WASHBURN AVE AND ROBEY STREET,
CHICAGO, ILL.

CLARENCE I. WOLFINGER,

General :::::
Contractor

CARPENTRY AND FINE CABINET WORK
A SPECIALTY.

Rooms 59 and 60, 164 La Salle St. CHICAGO
Telephone, Main 3841.....

The WOLLAEGER MFG. CO.

Fine
Interior Finish

MILWAUKEE,
WIS.

Telephone Main 888.

C. EVERETT CLARK

General Contractor
.... and Builder ....

Suite 1303, Title and Trust Bldg. — 100 Washington Street, CHICAGO.

E. F. PIERCE, Superintendent.

TELEPHONE H. 500.

W. A. & A. E. WELLS

Building
Contractors,

W. A. WELLS.
A. E. WELLS.
F. A. WELLS.

Suite 1014
Monadnock Building,
CHICAGO.....

ARCHITECTURAL MODELINGS
and Columns.
English Mosaics and Tiles :::::: Leaded Glass.

EDWIN D. WEARY,
1449 Marquette Building, . . CHICAGO.
Send for Catalogue.

TELEPHONE MAIN 1135

F. H. SAMMIS CO.

Dealers in
Marble and Granite
FOREIGN AND DOMESTIC

And Manufacturers of
FINE INTERIOR FINISH
MOSAIC AND TILE

Office: 159 LA SALLE STREET
Mill: 52d and Wallace Sts. CHICAGO.

Hardwood Floors

Wood Carpets, Parquet Floors, Rug Borders.

Send for book of designs.

E. B. MOORE & CO.
48 & 50 Randolph Street,
CHICAGO, ILL.

Byrkit's Sheathing Lath and Lyon Crowned Joists

are what make **true walls, ceilings and floors** in every building. Can be supplied by all lumber dealers. **Architects will benefit their clients by specifying them.** Don't be imposed upon by **imitations.** For information and circulars, address

The Byrkit-Hall
Sheathing Lath Co.
159 La Salle Street,
CHICAGO, ILL.

Ready Rock Asphalt Roofing

ASPHALT PAINTS AND CEMENTS,

Screened Gravel, Trinidad Asphalt, Burlap, Rosin-sized Paper.

(The surface of the Trinidad Asphalt lake, exposed to the weather for centuries, shows no perceptible decay.)

WEST COAST ROOFING CO., 1023 Monadnock
Telephone 202 Harrison. CHICAGO.

The Winslow Bros. Company....Chicago

ORNAMENTAL
IRON AND BRONZE

GATES — FENCES
GRILLES — LANTERNS
TABLETS — BAS-RELIEFS

Gardner Sash Balance Co.

MANUFACTURERS OF
Steel Ribbon and Attachments...

RIBBON SASH PULLEYS.
CHAIN SASH PULLEYS.
ROPE SASH PULLEYS.
SASH LOCKS.

First National Bank Bldg. CHICAGO, ILL.

THE WINDOW SWINGING CO.

OF CHICAGO.
1453 Monadnock Block.

We fit any Windows, NEW or OLD, to Swing INSIDE THE ROOM.

NO CHANGE OF FRAME OR SASH AND NO PERMANENT FIXTURES

Ours is the BEST, CHEAPEST and Most Practical Device In Existence.

Send for Illustrated Catalogue. Estimates Furnished.

TELEPHONE, MAIN 2129. MILLS: ERIE, PA.

H. F. WATSON CO.

MANUFACTURERS OF
Building and Roofing Papers
ASBESTOS PRODUCTS.

Pipe and Boiler Covering, Steam Packings, Asbestos Roofing, Carpet Linings, Imperial Brand 2 and 3 Ply Prepared Roofing Materials.

COAL TAR PRODUCTS.

190-192 Fifth Avenue - - CHICAGO, ILL.

J. G. McFARLAND,

Galvanized Iron and
Copper Cornices,

SLATE ROOFER ..TILE

TIN AND IRON SKYLIGHT AND GLAZED WORK, FIRE PROOF WINDOWS, FRAME AND SASH, WIRE GLASS.

2511-2519 STATE STREET,
CHICAGO.

Contracts Taken in Any Part of the United States. TELEPHONE SO. 158.

Wilks' Hot Water Heaters and Steam Generators.

Best in Use for all Purposes Heating and Supplying Hot Water.

All Steel. No Coils or Flues. All Sizes.

SEND FOR CATALOGUE.

S. Wilks Mfg. Co.

51-53 S. Clinton St., Chicago.

N. S. BOUTON, Pres.
E. H. SEDGWICK, Treas. and Gen. Mgr.

M. Hilty Lumber Co.

Lumber

Milwaukee, . . Wis.

Note our Method of Applying the Veneer. This absolutely prevents Peeling or Blistering. Our Doors are the best in the market. Send us your Lists for Estimates.....

COMPOUND DOOR CO.,
ST. JOSEPH, MICH.
Manufacturers of Doors and Fine Interior Finish.

Sidewalk Lights

SEND FOR CATALOGUE.

Brown Bros. Mfg. Co.

Established in 1860.

N. W. Cor. Jackson Boul. and Clinton St.

Chicago.

Telephone, Main 4085.

Luminous Prisms

LIGHT DARK INTERIORS.

LUMINOUS PRISM CO.

27-29 South Clinton Street, Chicago.

Tiffany Enameled Brick Company

All Colors—ENAMELED BRICK AND TILE—Bright and Dull Finish.

204 Dearborn Street, Marquette Bldg.

Long-Distance Telephone, Express 579. CHICAGO.

Write for Prices on..... **TILE FOR FIREPROOFING** ALL KINDS OF BUILDINGS

Our Goods Embody the Latest Scientific Ideas for Rendering Buildings Thoroughly Fireproof.....Our Illustrated Catalogue will Interest You.

PIONEER FIREPROOF CONSTRUCTION COMPANY, MARQUETTE BUILDING, CHICAGO.

POROUS FIREPROOFING

Telephone, Express 23.

Illinois Terra Cotta Lumber Co.

Office:
461 The Rookery, CHICAGO.

WORKS AT PULLMAN.

ILLINOIS VALLEY CLAY CO. WORKS: Twin Bluffs, Near Ottawa, Ill. YARDS: 688 South Canal Street.

Telephone, Express 352. **Fire Clay Tile and Porous Terra Cotta**

Partitions, Floor Arches, Co mn and Girder Covering, Booktile Roofs, Brewery Insulation, Salt Glazed Tile, Etc.

Office, 84 Hartford Building, CHICAGO.

FIREPROOFING MATERIAL.

Ludowici Roofing Tile Company..419 Chamber of Commerce Bldg., CHICAGO...Telephone, Main 1824.

Manufacturers of the Most Perfectly Devised and Best Made

INTERLOCKING ROOFING TILE.

Architects, Reflect... Tile requires no heavier construction than slate. Paper under either makes a warmer roof. For Factories, Warehouses and Power Houses save your sheathing by using strips (1 x 2). Complete specifications for laying with sheathing or without will be furnished upon application. Write for new Catalogue.

ELEVATOR SUPPLY AND REPAIR CO.....

PHONE MAIN 1741

34-36 WEST MONROE STREET.....CHICAGO.

Elevator Floor Indicators, Electric Elevator Signals, Improved Flash-Light Annunciator.
(Signaling Operator of First Car.)

Our Apparatus is in Constant Use in the Finest Buildings of the Country.

A. E. COLEMAN, Pres. A. VANDERKLOOT, Vice-Pres. JAMES E. LOW, Sec'y.

CHICAGO ORNAMENTAL IRON CO.

Ornamental Iron and Bronze

26th and S. Halsted Streets, CHICAGO.

H. SHEELER Is prepared with capital, years of experience and complete working outfit to contract for

Moving and Raising Buildings Anywhere on Earth.

Special attention paid to shoring up fronts, columns, girders, etc., and to shoring and straightening up floors. Estimates cheerfully furnished.

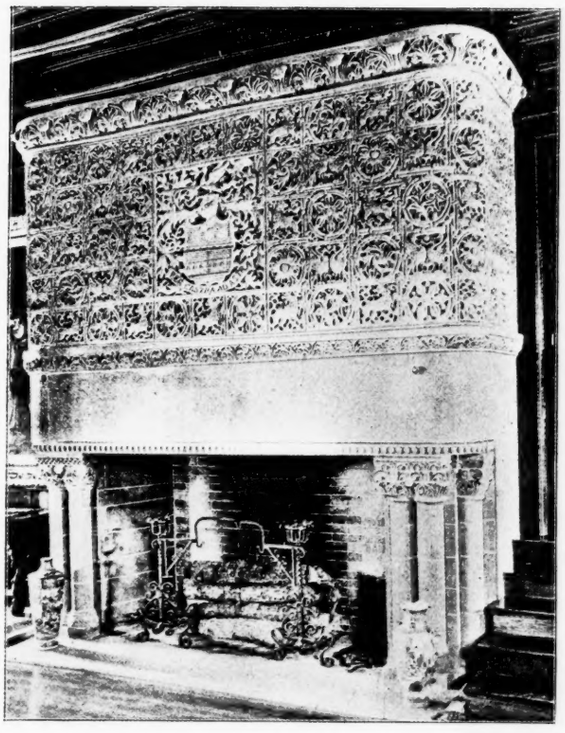
H. SHEELER, 115 DEARBORN STREET, CHICAGO.

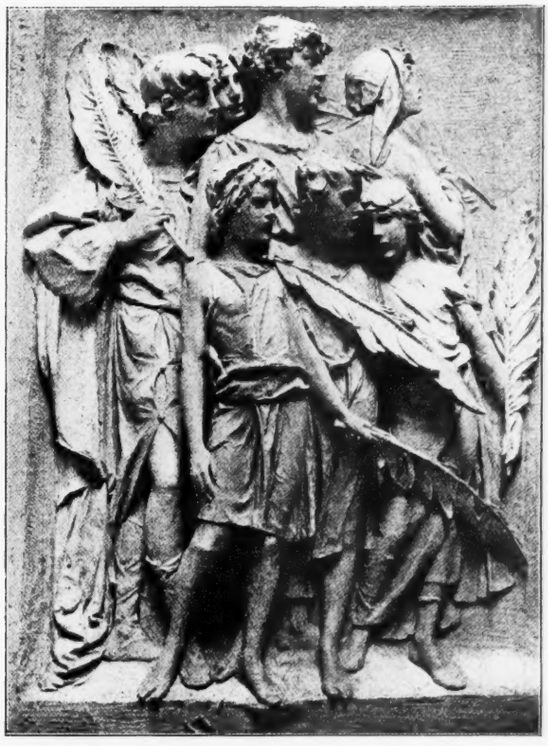
American Laundry Machinery Co. CHICAGO. CINCINNATI. NEW YORK.

Plans and Estimates Furnished for Architects.....Complete Outfits for Public and Private Institutions a Specialty.

Manufacturers of All Needed.....

Laundry Appliances.





ROBERT W. HUNT & CO., CHICAGO. HALLSTED & McNAUGHER, PITTSBURG.

Bureau of Inspection, Tests and Consultation.

1121 THE ROOKERY, CHICAGO. MONONGAHELA BANK BLD'G, PITTSBURG.

INSPECTION OF

Structural Materials, Steel Rails, Splice Bars, Railroad Cars, Wheels, Axles, etc.

CHEMICAL LABORATORY.—Analysis of Ores, Iron, Steel, Oils, Water, etc.

PHYSICAL LABORATORY.—Test of Metals, Drop and Pulling Test of Couplers, Draw Bars, etc.

Efficiency Tests of Boilers, Engines and Locomotives.

TELEPHONE, WEST 757.

FREDERICK VOSS

MANUFACTURER OF

Architectural and Decorative Wire and Iron Work...

Bank and Office Railings, Elevator and Window Guards, Stair Rails, Iron Fences. Stable Fittings, Wire Cloth and Wire Goods of Every Description....

WIRE LATHING a Specialty.

617 to 621 Austin Ave. - CHICAGO.
Cor. Lincoln Street.

GLOBE IRON WORKS

H. A. STREETER, Prop.

35 to 41 Indiana Street.

Specialties:

Streeter's Patent Steel Clip.

Iron Shutters...Iron Sash...Iron Doors.

Iron Jail Work.

IRON WORK OF ALL KINDS....

HALSTED BROTHERS,

Architectural ...Iron Work

388-390 W. Randolph St.,
CHICAGO.

FIREPROOF FLOORING OF STEEL WOVEN WIRE

The American Steel & Wire Co.

General Offices:
The Rookery, CHICAGO, ILL.,

Is the world's largest manufacturer of the above, as well as

WIRE NAILS

And all kinds of smooth **WIRES**—plain, tinned, coppered, galvanized, for every conceivable purpose.

Soper Lumber Co.

Lumber

Large Stock. Prompt Shipments.

723 Laflin Street,
CHICAGO.

NEW YORK OFFICE, 320 Broadway. BOSTON OFFICE, 7 Exchange Place.

M. SALOMON, PRESIDENT.

Chicago Architectural Iron Works Incorporated.

DESIGNERS AND MANUFACTURERS OF Telephone, West 378.

Artistic Metal Work
Plain and Ornamental Cast and Wrought Iron
Bronze and Brass Work
Electro Plating, Bower Barff and Galvano Plastic
Work...Designs and Estimates Furnished

OAKLEY AVE. and KINZIE ST.

Branch Office, Suite 609 Roanoke Bldg. S. E. Cor. La Salle and Madison Sts. CHICAGO.

TELEPHONE, MAIN 1908.

ASBESTOS

PIPE COVERING
CEMENTS
ROOFING
PAINTS
PACKINGS
PAPER
FIBER

MINERAL WOOL

FOR INSULATION AND DEAFENING

ANTI-FLAME

FIREPROOF COATING

Chicago Fireproof Covering Co.

Tel., M. 2763. 18 and 20 N. Canal Street.

A Story of Progress

Send for copy

LARGEST RADIATOR MAKERS
LARGEST BOILER MAKERS
LARGEST ASSORTMENT
LARGEST VALUES

AMERICAN RADIATOR COMPANY

CHICAGO NEW YORK BOSTON PHILADELPHIA ST. LOUIS
BUFFALO MINNEAPOLIS DENVER

White Enamelite

.....AN ENAMEL PAINT FOR COLONIAL INTERIORS

Supremis Floor Finish

Shipoleum

.....FOR STANDING FINISH

These give a Beautiful and Extremely Durable Finish

Send for our Book "The Treatment of Floors," the most complete treatise on this subject ever issued....

CHICAGO VARNISH COMPANY

ESTABLISHED 1865

CHICAGO NEW YORK BOSTON

Blue Book for the Register Trade

LARGEST LIST OF SIZES MADE.

Registers Made of Ferrosteel are Noted for Great Strength, Superior Finish, Excellent Workmanship, Artistic and Practical Designs, Ease of Control.

THE FERROSTEEL CO.

86-88 Water Street,
CLEVELAND, OHIO.

Chicago Branch.....
45-47 Lake Street.

Boston Branch.....
92 North Street.

HIGHEST GRADE
ELECTRIC WIRING

Chicago Edison Company

ELECTRIC LIGHT
ELECTRIC POWER

ASK FOR FIGURES

HULL HOUSE AND THE CHILDREN'S BUILDING.

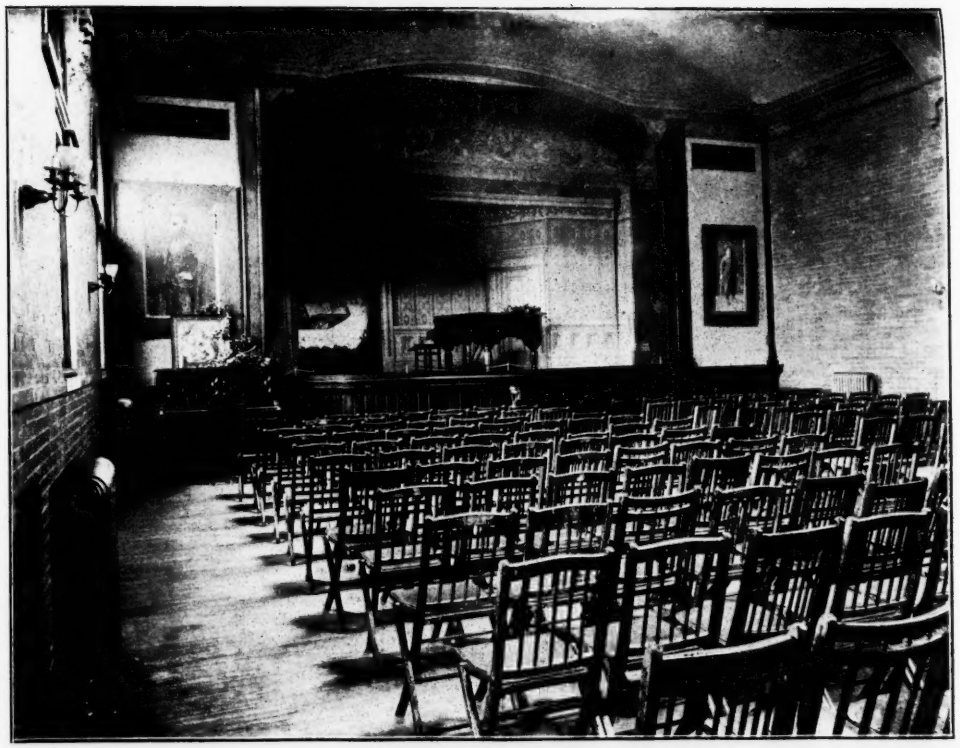
R. Capes, Photo., Chicago.

THE AUDITORIUM AND COFFEEHOUSE.

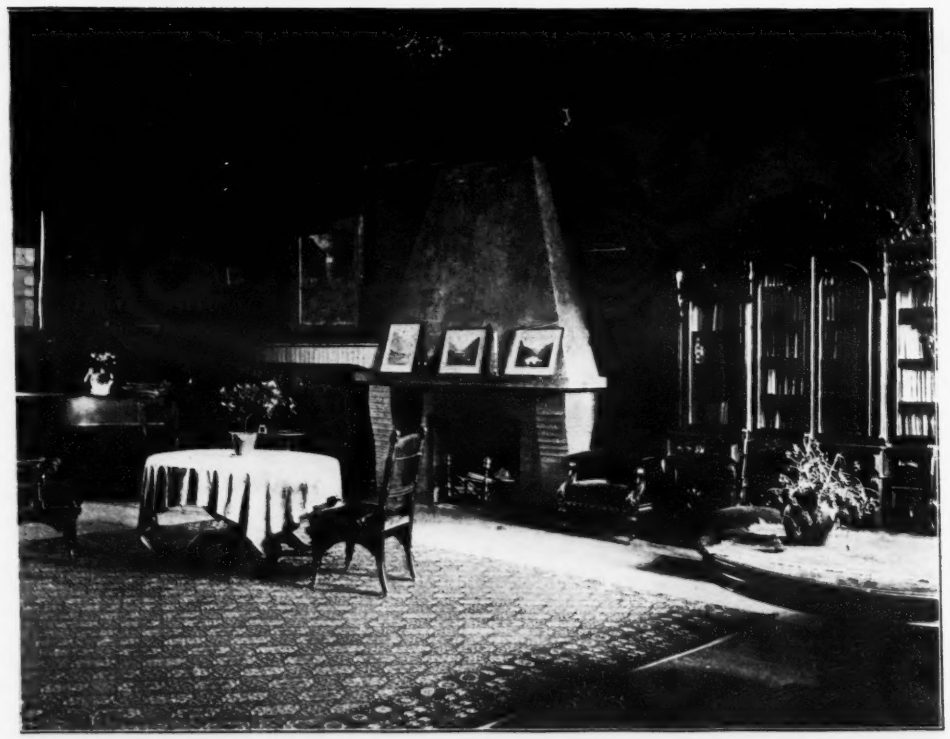
THE HULL HOUSE GROUP, CHICAGO.

POND & POND, ARCHITECTS.

COFFEE-ROOM.



AUDITORIUM.



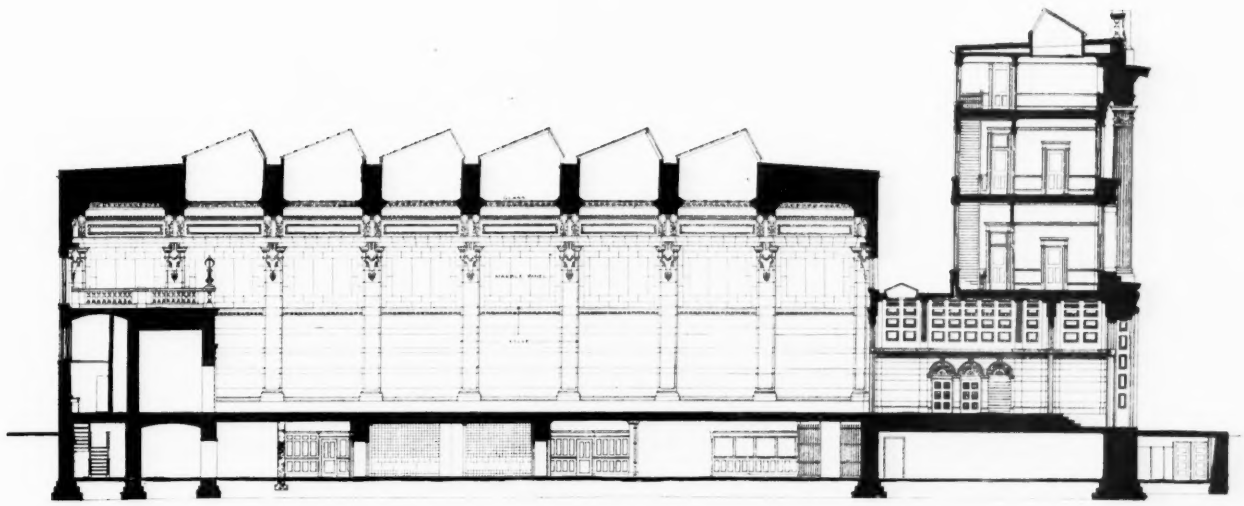
LECTURE-ROOM.

LIVING-ROOM.

VIEWS IN HULL HOUSE, CHICAGO.

POND & POND, ARCHITECTS.

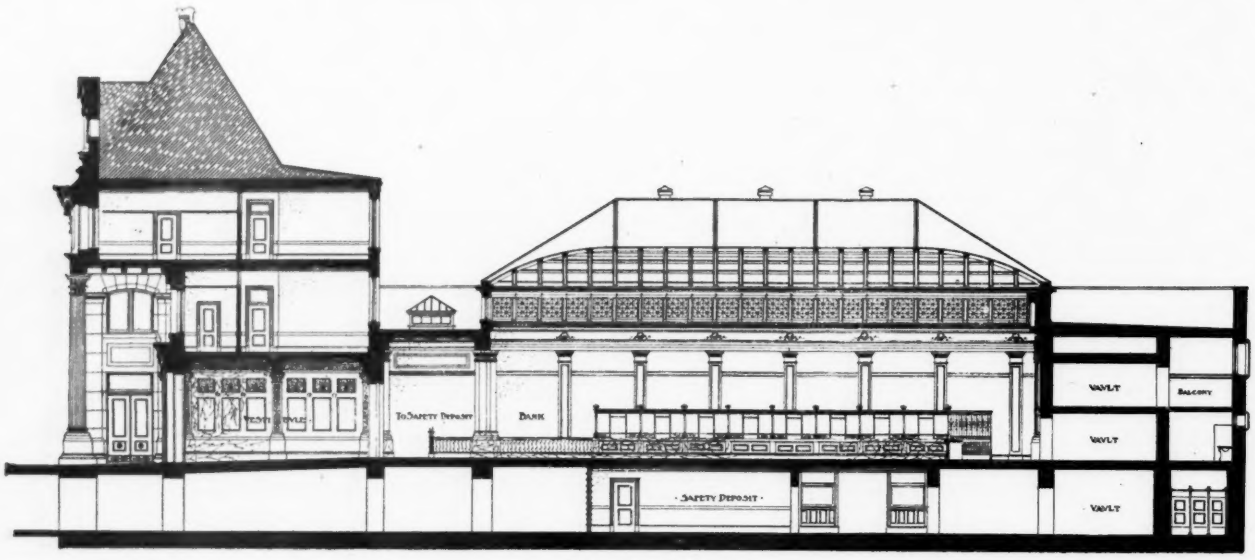
SUBMITTED BY THEODORE WELLS PIETSCH, ARCHITECT, CHICAGO.



LONGITUDINAL SECTION
SCALE 1/8 IN = 1FT.

SUBMITTED BY FROST & GRANGER, ARCHITECTS, CHICAGO.

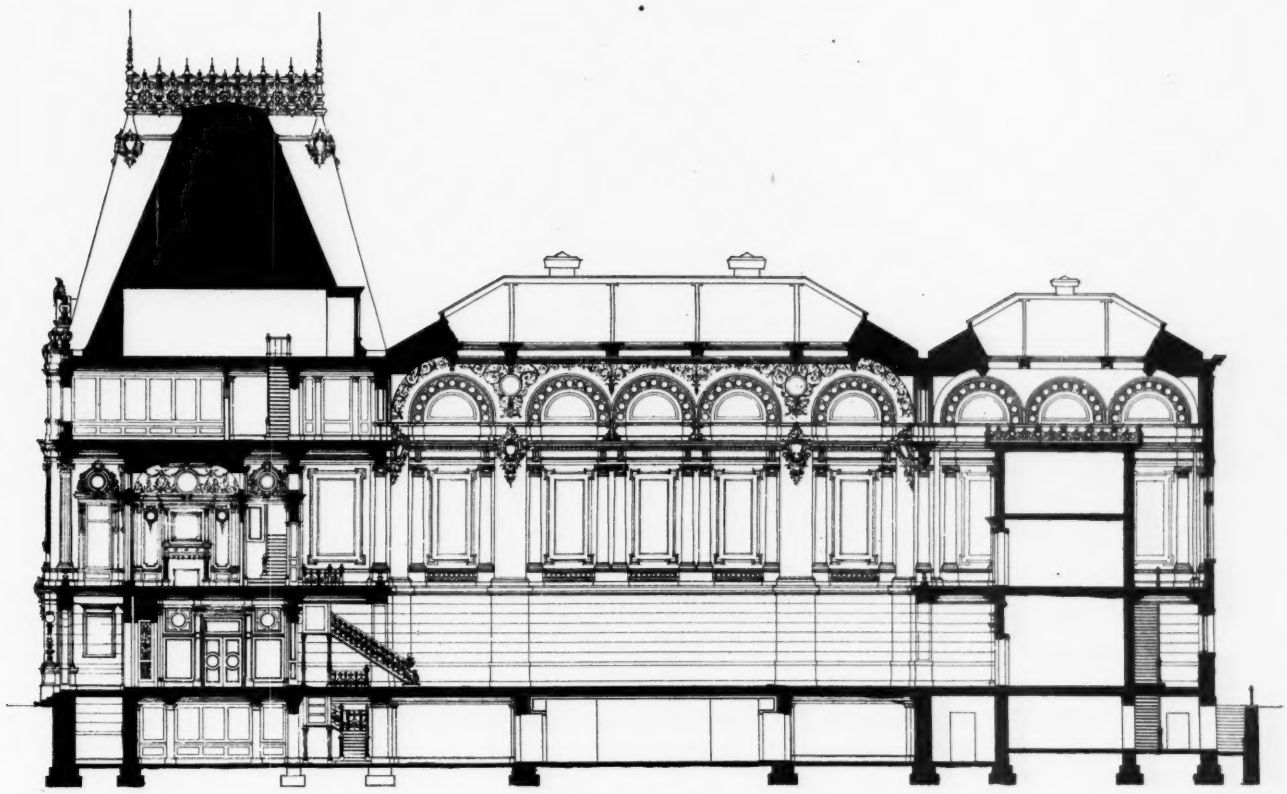
CHICAGO NATIONAL BANK BUILDING.

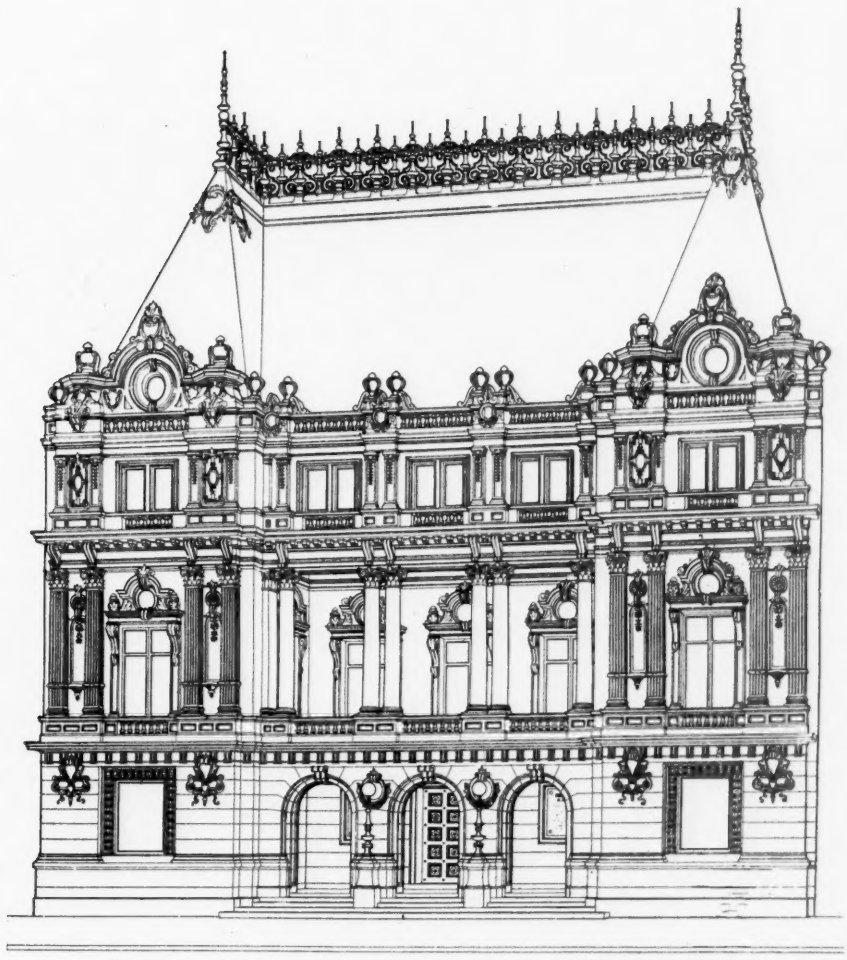


LONGITUDINAL SECTION.

SUBMITTED BY S. S. BEMAN, ARCHITECT, CHICAGO.

COMPETITION DESIGNS FOR THE CHICAGO



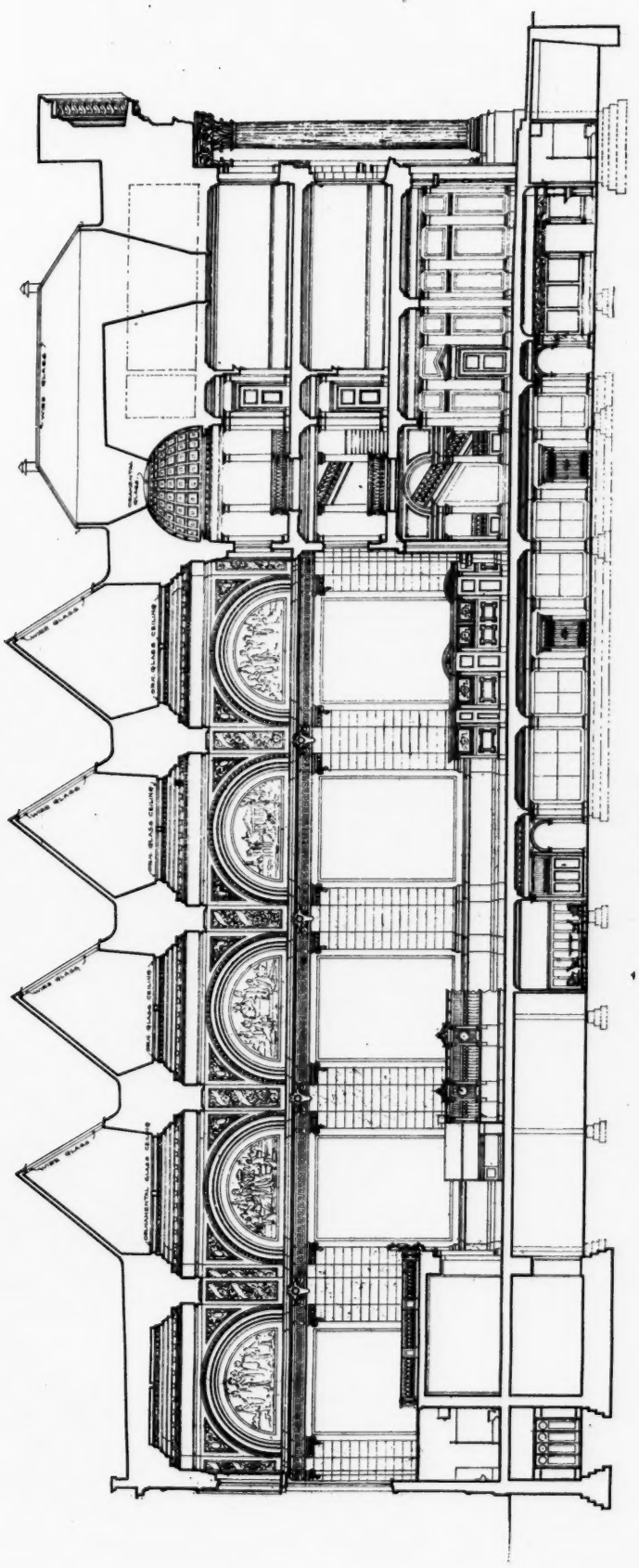


SUBMITTED BY WATSON & HAZLETON, ARCHITECTS, CHICAGO.

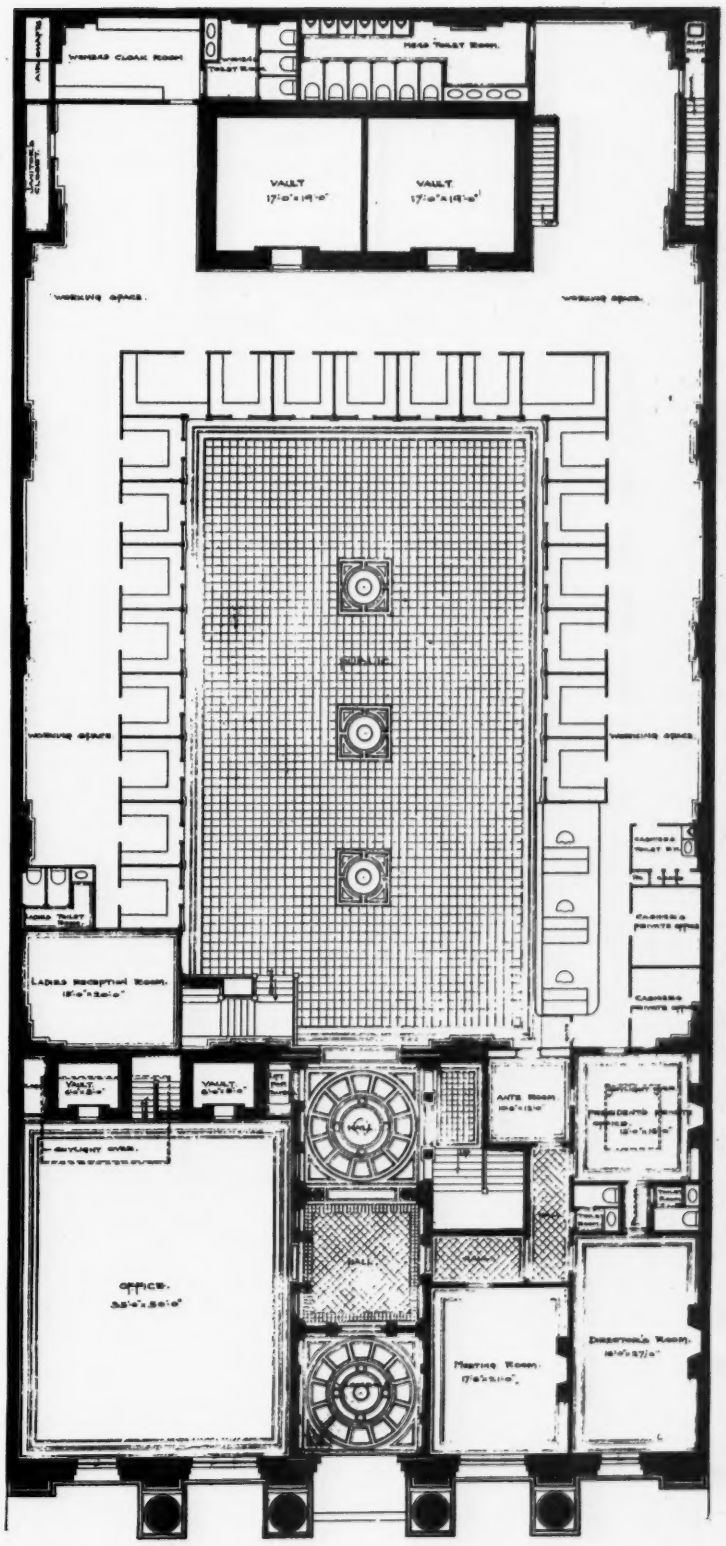
E CHICAGO NATIONAL BANK BUILDING.

ACCEPTED DESIGN, COMPETITION FOR THE CHICA

JENNEY & MUNDIE, ARCHITECTS,

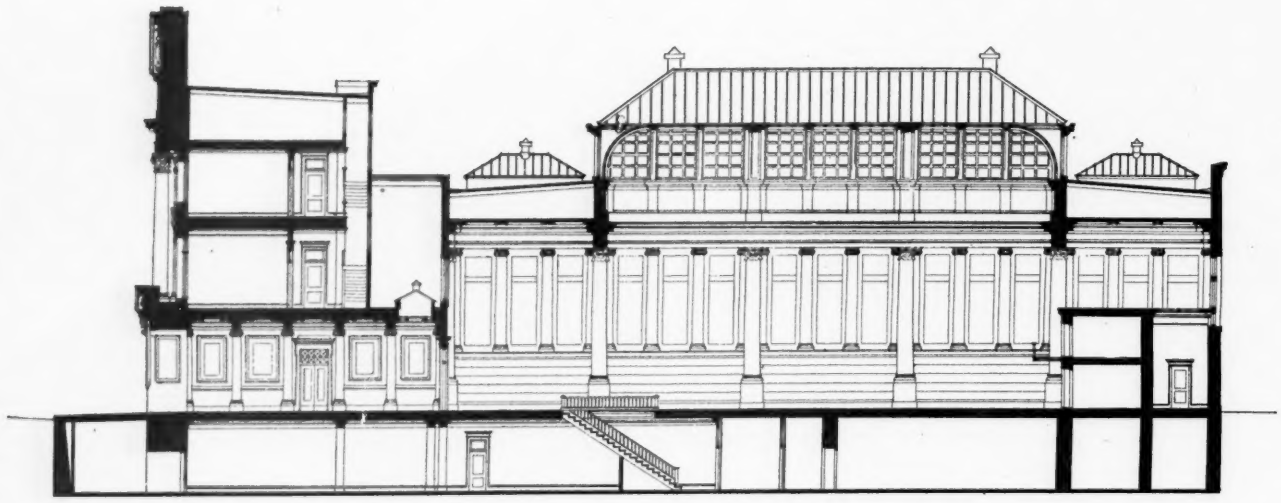


SECTION

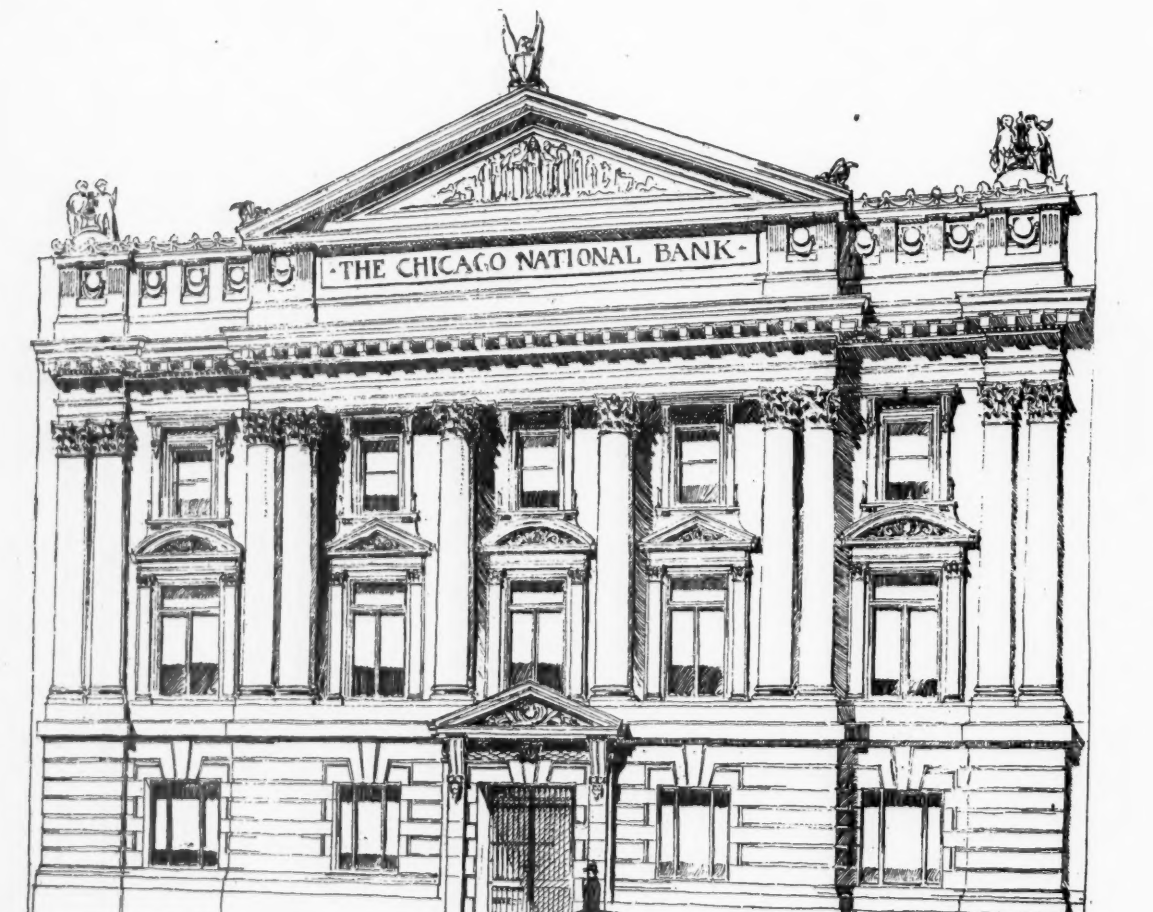


R THE CHICAGO NATIONAL BANK BUILDING.

IDIE, ARCHITECTS, CHICAGO.

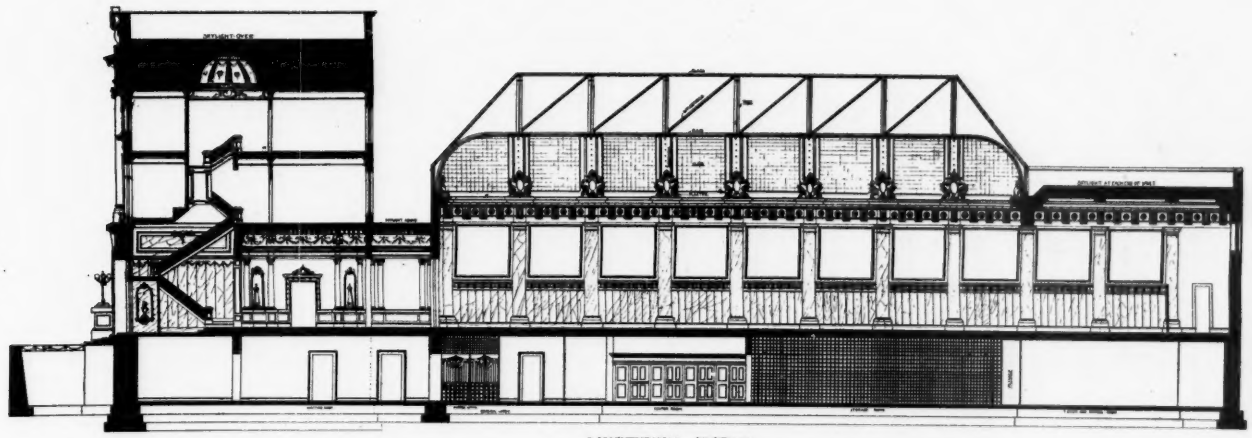


LONGITUDINAL SECTION

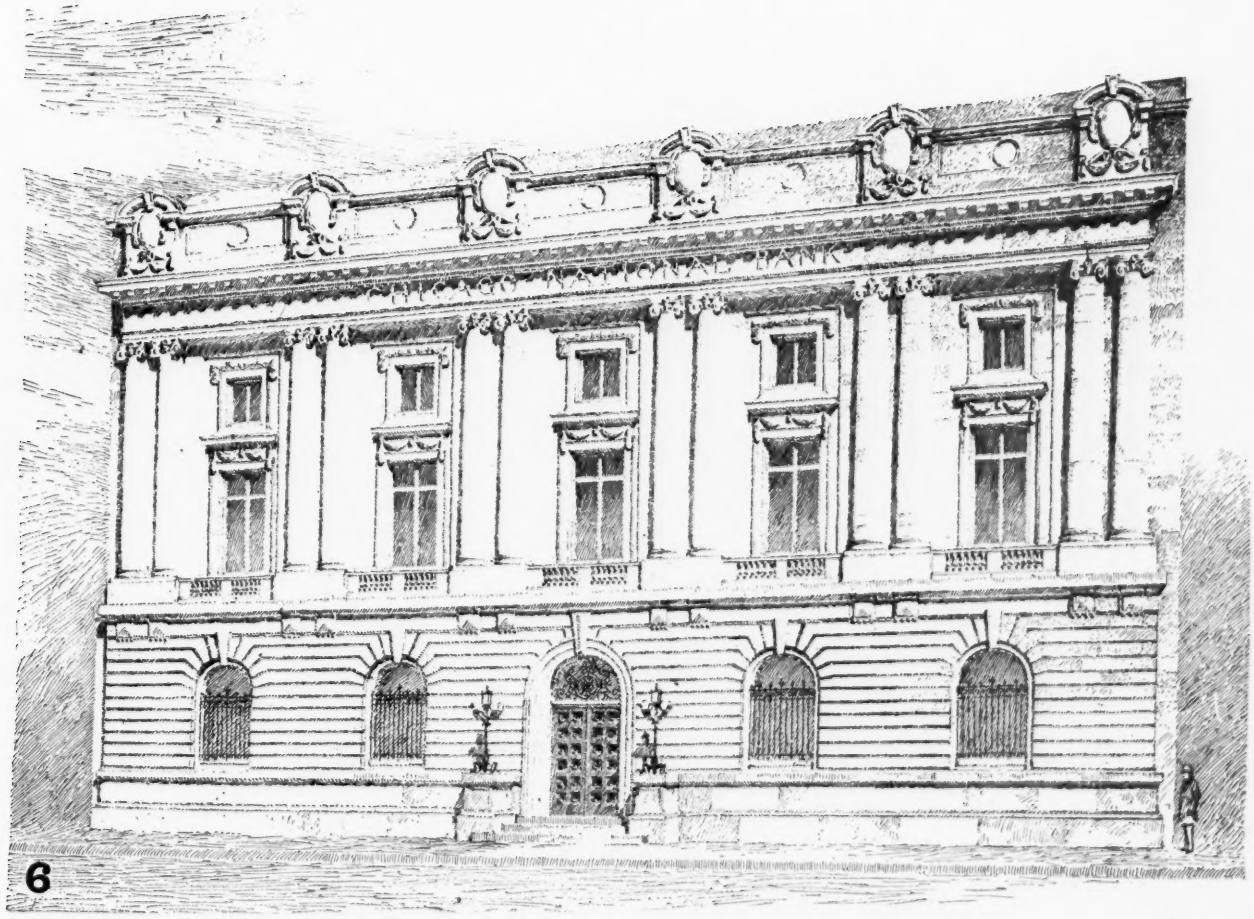


SUBMITTED BY JOHN MCMICHAEL, ARCHITECT, CHICAGO.

COMPETITION DESIGNS FOR THE CHICAGO NAT

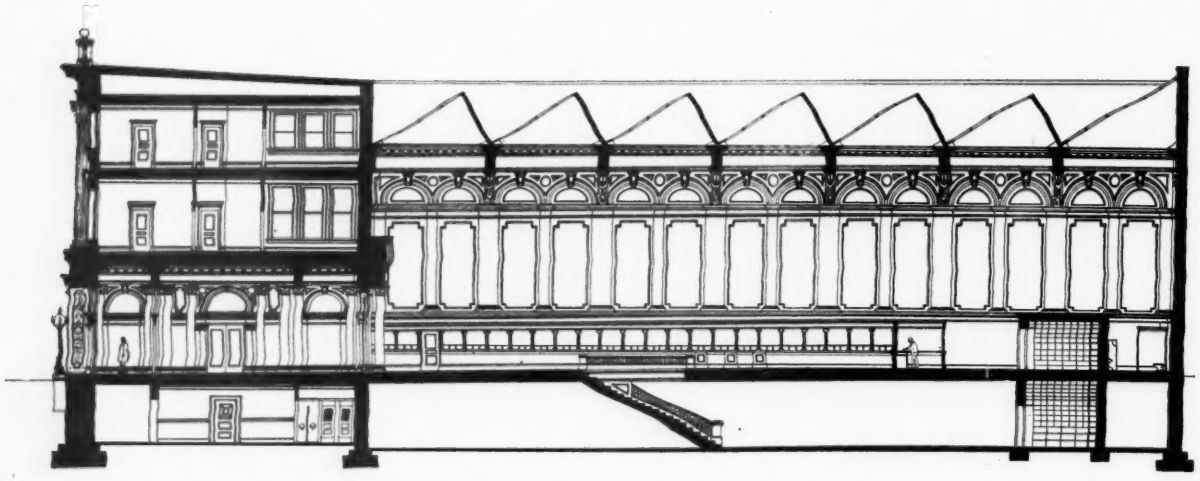


·LONGITUDINAL · SECTION·

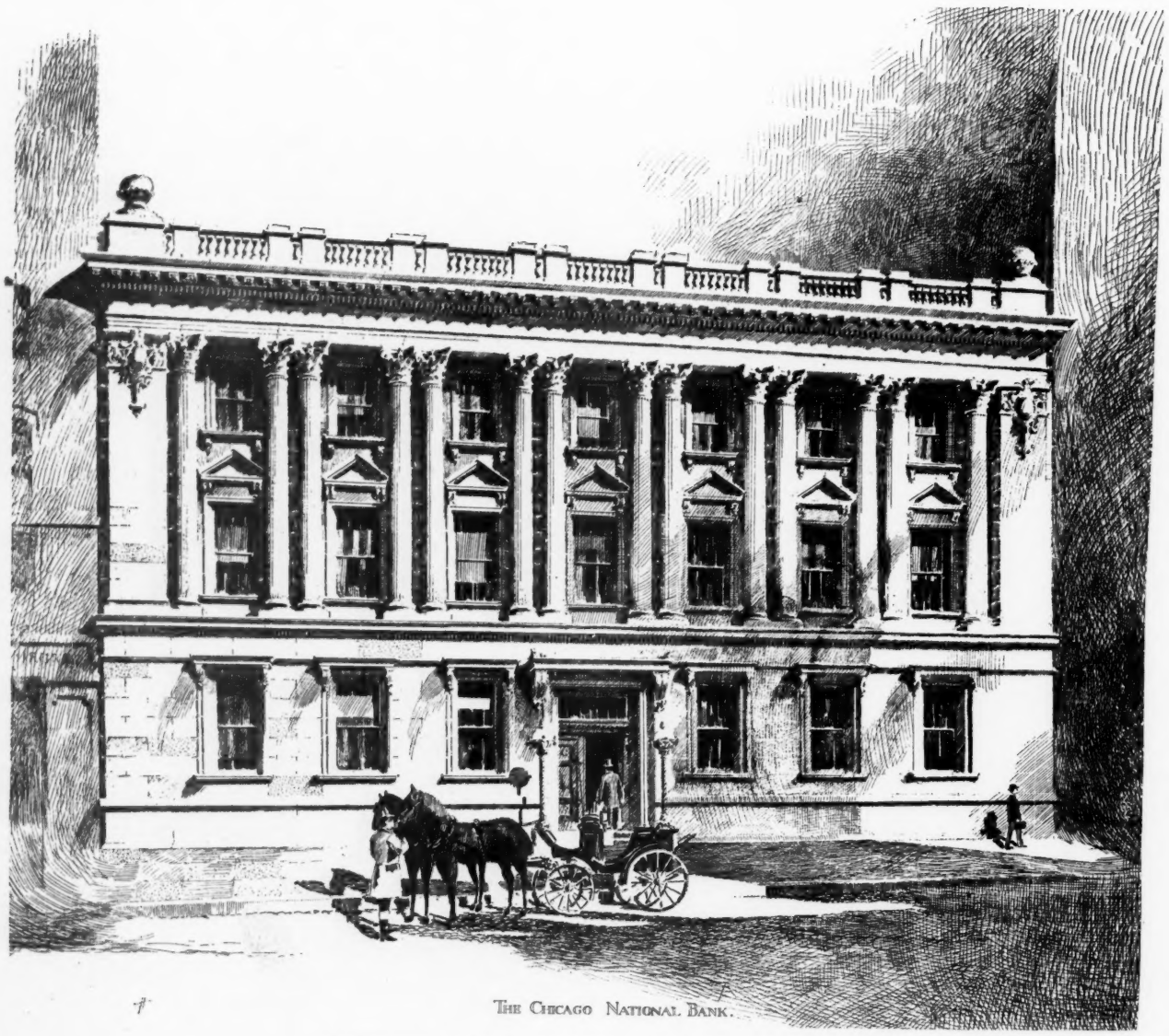


SUBMITTED BY WILSON & MARSHALL, ARCHITECTS, CHICAGO.

CHICAGO NATIONAL BANK BUILDING.

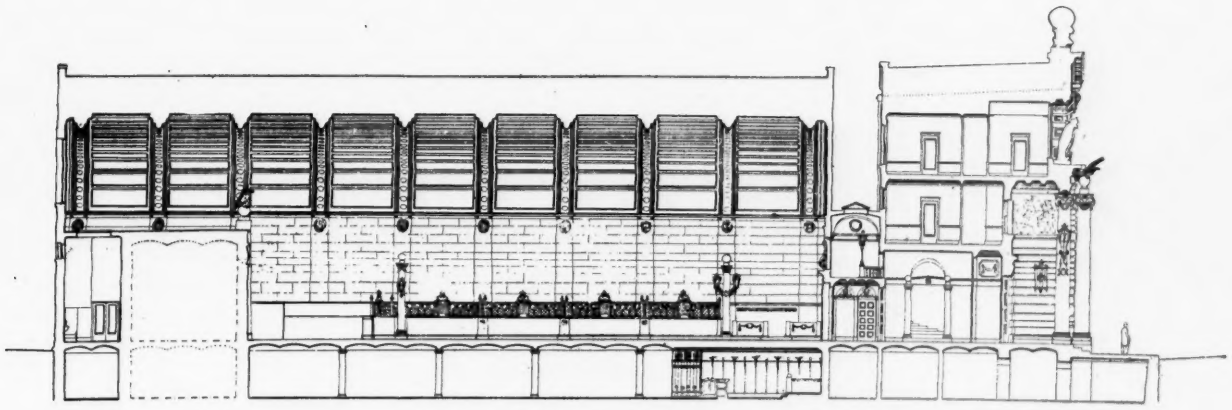


LONGITUDINAL SECTION.

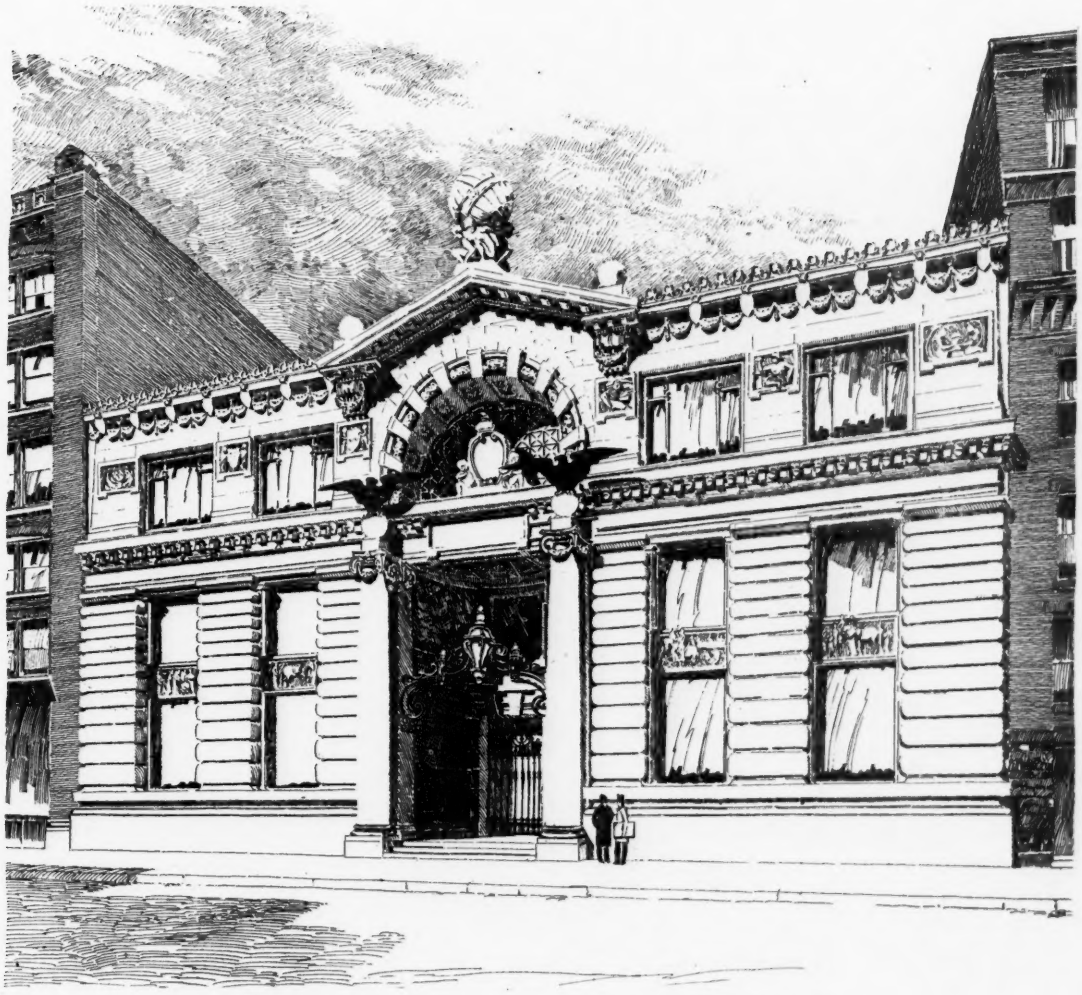


THE CHICAGO NATIONAL BANK.

SUBMITTED BY HENRY IVES COBB, ARCHITECT, CHICAGO.

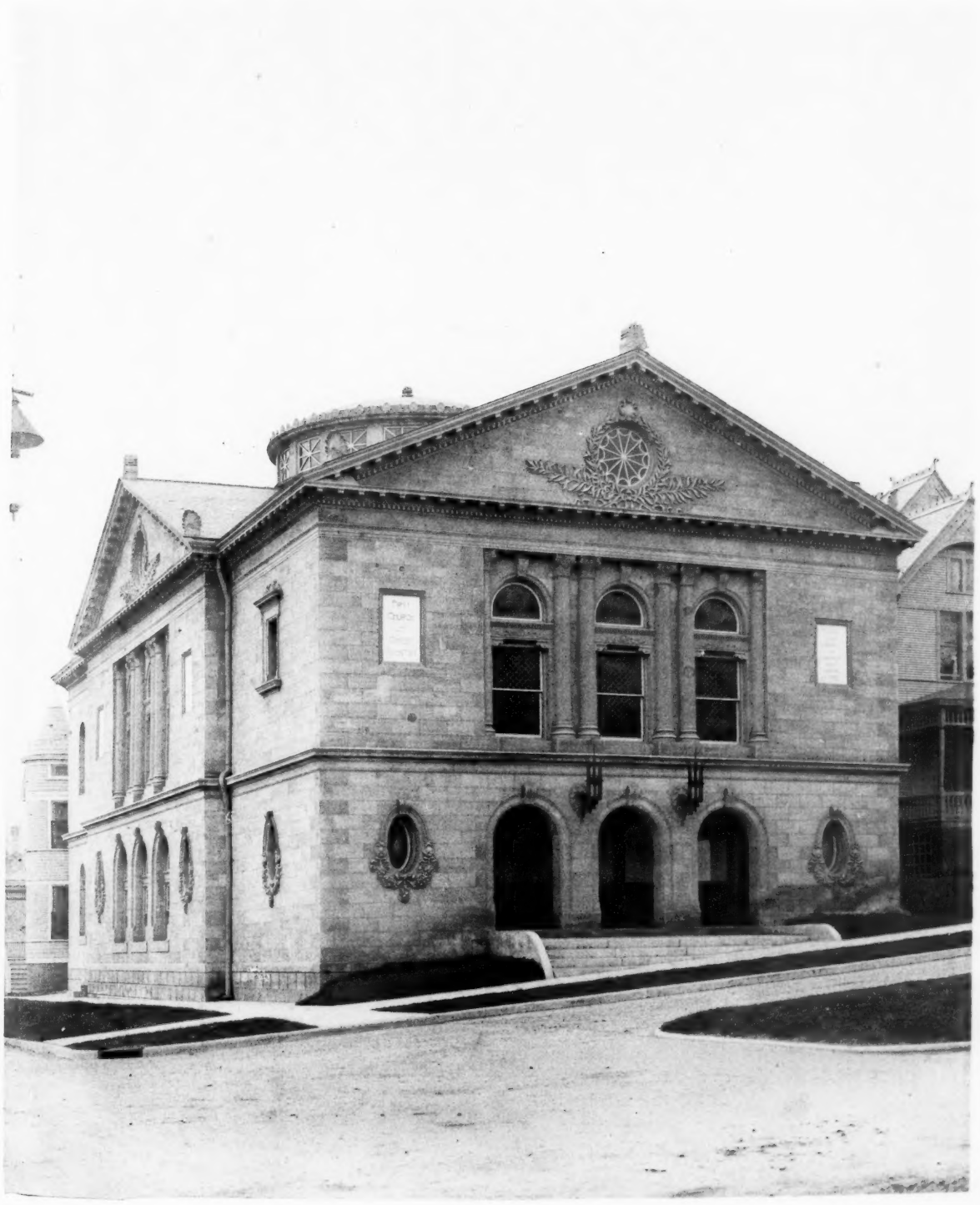


LONGITUDINAL SECTION CHICAGO NATIONAL BANK



SUBMITTED BY HOWARD V. D. SHAW, ARCHITECT, CHICAGO.

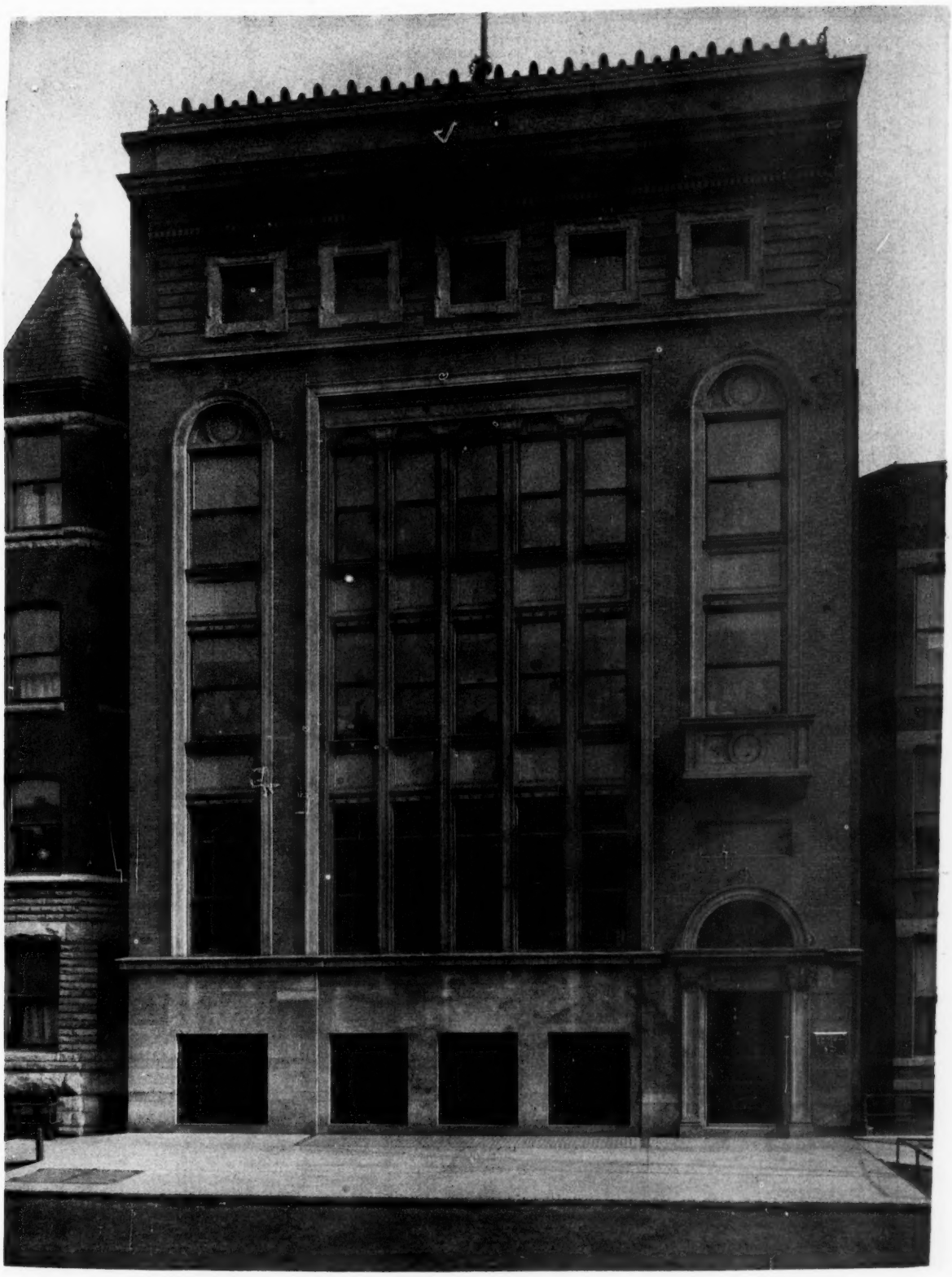
THE CHICAGO NATIONAL BANK BUILDING.



Dewein, Photo. INLAND ARCHITECT PRESS.

FIRST CHURCH OF CHRIST, SCIENTIST, PEORIA, ILLINOIS.

REEVES & BAILLIE, ARCHITECTS.



H. E. Torgersen & Co., Photo., Chicago. INLAND ARCHITECT PRESS.

WAREHOUSE FOR E. C. DE WITT & CO., CHICAGO.

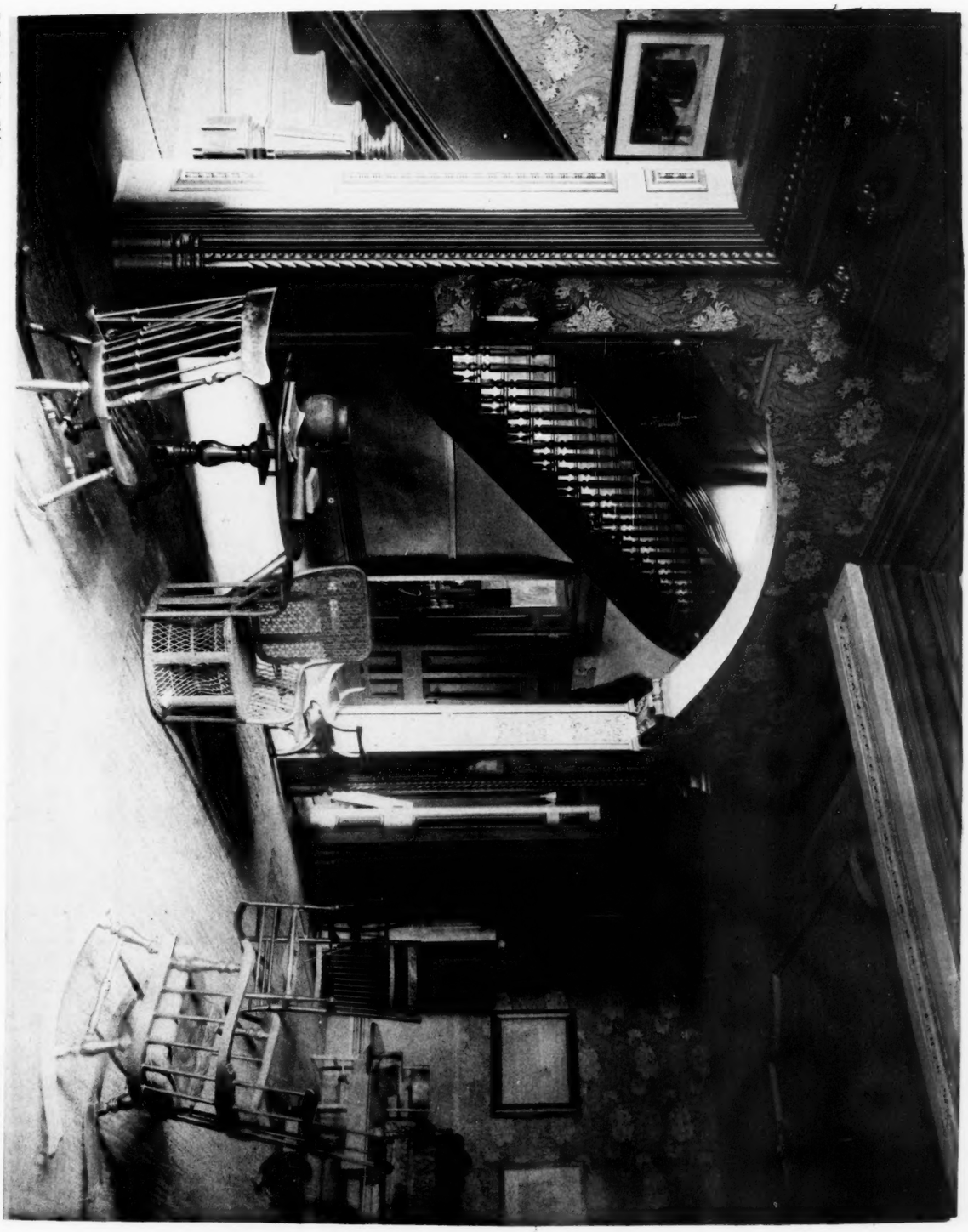
SAMUEL K. COLTON, ARCHITECT.

INLAND ARCHITECT PRESS.

SPALDING INSTITUTE, PEORIA, ILLINOIS.

REEVES & BAILLIE, ARCHITECTS.

POND & POND, ARCHITECTS.



R. Capes, Photo., Chicago.

HULL HOUSE—THE RECEPTION HALL.

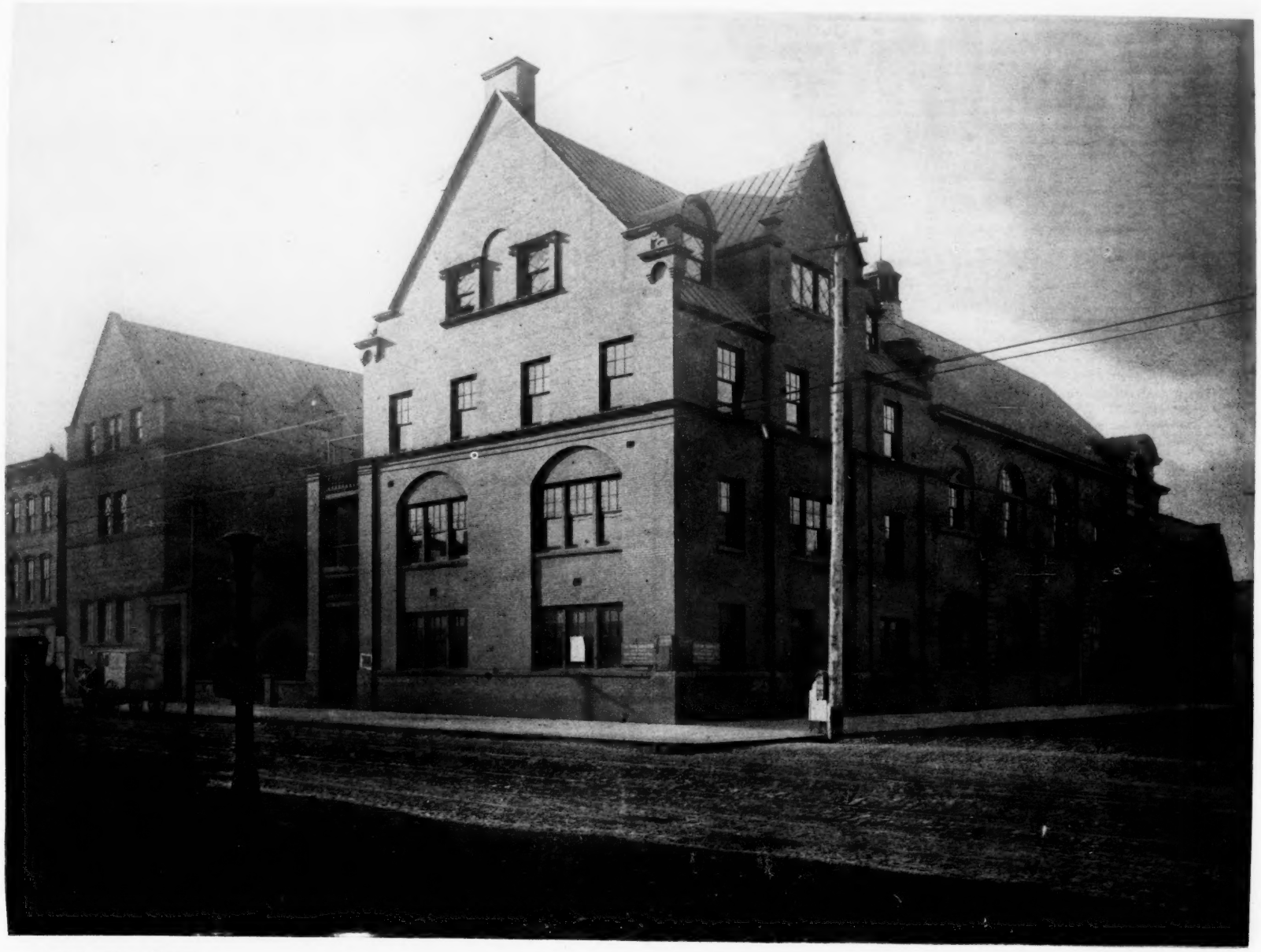
POND & POND, ARCHITECTS.

INLAND ARCHITECT PRESS.

R. Capes, Photo., Chicago. INLAND ARCHITECT PRESS.

HULL HOUSE—THE COFFEE ROOM.

POND & POND, ARCHITECTS.



R. Capes, Photo., Chicago. INLAND ARCHITECT PRESS.

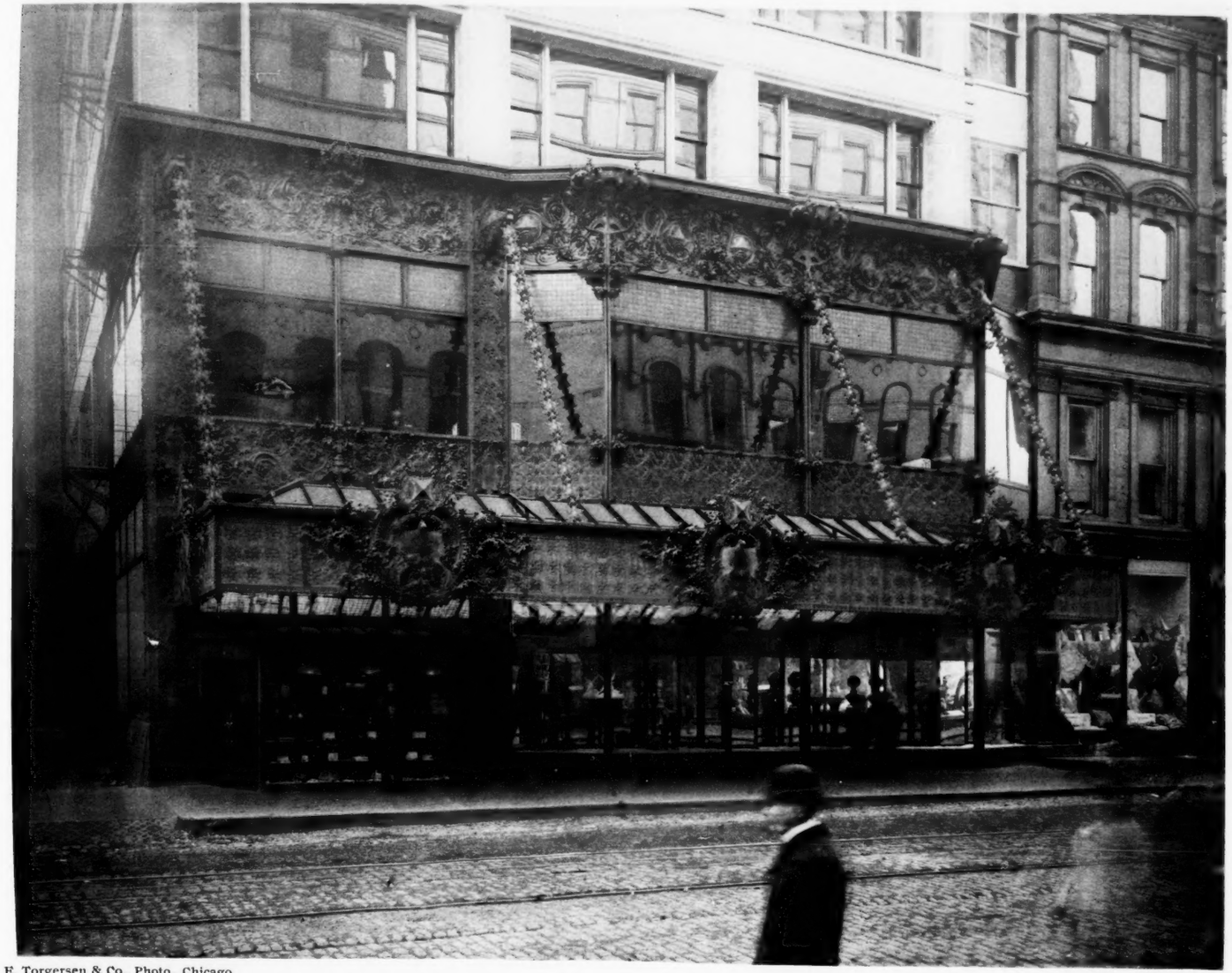
THE HULL HOUSE GROUP, SOUTH HALSTED AND POLK STREETS, CHICAGO.

POND & POND, ARCHITECTS.

H. E. Torgersen & Co., Photo., Chicago. INLAND ARCHITECT PRESS.

RESIDENCE OF FLOYD J. SMITH, CHICAGO.

R. A. DENELL, ARCHITECT.



H. E. Torgersen & Co., Photo., Chicago.

INLAND ARCHITECT PRESS.

LOWER STORIES, STORE BUILDING FOR SCHLESINGER & MAYER, CHICAGO.

LOUIS H. SULLIVAN, ARCHITECT.

C. Howard Walker on Municipal Architecture.

IRVING K. POND, DES.

LORADO TAFT, SCULPT.

THE INLAND ARCHITECT AND NEWS RECORD

Entered at the Postoffice at Chicago as second-class matter.

CONTENTS.

EDITORIAL: PAGE

C. Howard Walker's European Investigations of Municipal Architecture—A Supreme Court's Decision in Regard to a High Building Law 41

MUNICIPAL LAWS IN RELATION TO ARCHITECTURE:
By C. Howard Walker, F.A.I.A 42

CHICAGO NATIONAL BANK BUILDING COMPETITION 43

MODERN FRENCH ARCHITECTURE:
By Theodore Wells Pietsch 45

ARCHITECTURAL ADVANCEMENT IN CHICAGO 46

ARCHITECTURE IN A SHOPPING DISTRICT 46

PROSPECTUS OF A TENEMENT-HOUSE COMPETITION 47

A NEW PARIS COMPETITION 47

PAINTS IN ARCHITECTURE 48

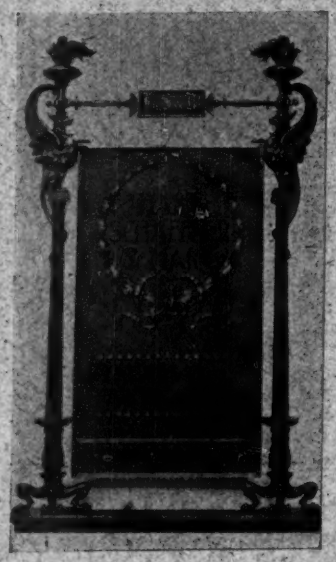
NEW PUBLICATIONS 48

ESTIMATING FRAME AND BRICK HOUSES 48

OUR ILLUSTRATIONS 48

INDEX TO ADVERTISEMENTS XI

THE WINSLOW BROS. COMPANY
CHICAGO



BRONZE SIGN. 3 ft., 6 in. high.

ORNAMENTAL IRON AND BRONZE

WANTED—Back Numbers
The Inland Architect

VOLUMES I to IX INCLUSIVE. In whole or in part.

Also, Intermediate News Numbers, Vol. X, No. 8; Vol. XIII, No. 6; Vol. XII, No. 8.
Address, stating price, THIS OFFICE.

THE USE OF
Fitch Sash Locks

Proves their Superiority as a Security Device; at once Simple and Durable; Adjusting the Sash; Preventing Rattling; Also Disfigurement of Top Sash by Keeping the Window "Locked or Unlocked." Small and large sizes in all finishes. Catalogue and working model on application.

THE W. & E. T. FITCH CO.,
NEW HAVEN, CONN.

NORTH-WESTERN TERRA-COTTA CO.

WORKS AND OFFICE:
Clybourn and Wrightwood Avenues.

BRANCH OFFICE: 1118 Rookery Building,
CHICAGO.

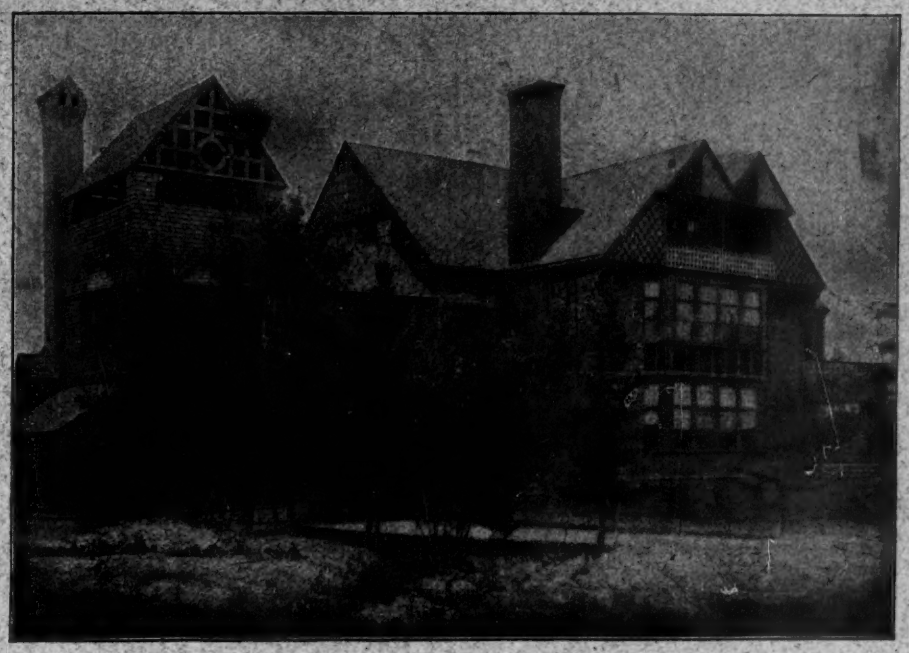
OTIS ELEVATOR COMPANY

NEW YORK
Empire Building

CHICAGO
Fisher Building

Passenger and Freight ELEVATORS

"The Standard of the World."



WM. RALPH EMERSON, Architect, BOSTON.

DEXTER BROTHERS' ENGLISH SHINGLE STAINS

ARE CARRIED IN STOCK BY THE

H. M. HOOKER CO., 57 West Randolph St., CHICAGO.

Testimonials from all over the United States and Canada tell of their durability under all conditions of climate. Send for sample boards and color-plates to

W. S. HUESTON, Agent, 45 Cliff Street, New York. **DEXTER BROTHERS, 55 and 57 Broad Street, Boston.**

THE POPULAR
INTERNATIONAL ROUTE
TO ALL LEADING
BUSINESS & PLEASURE RESORTS
IN THE EAST.

GRAND TRUNK RAILWAY SYSTEM

ONLY PULLMAN
PALACE CAR LINE
OPERATING MAGNIFICENT
VESTIBULE TRAINS
BETWEEN
CHICAGO & NEW YORK
Via NIAGARA FALLS.

THE GREATEST SCENIC ROUTE
THROUGH
PRINCIPAL CANADIAN CITIES.
LONDON,
HAMILTON,
TORONTO,
MONTREAL, Etc.
TO
BOSTON AND NEW ENGLAND.

FOR RATES, SLEEPING CAR RESERVATIONS, TIME TABLES, Etc., APPLY TO
ANY TICKET AGENT OF THE COMPANY.

TICKET OFFICE: CHICAGO, ILL., No. 249 CLARK STREET, CORNER JACKSON BOULEVARD.

J. W. TAYLOR,

1303 Owings Building, Chicago,

ARCHITECTURAL PHOTOGRAPHS,

BUILDINGS, INTERIORS, DETAILS, ETC.

Promise to purchase two dozen from the lot at $4.00 per dozen, unmounted, and I will send 200 from which to make the selection.

"Big Four" Route.

CHICAGO

TO

INDIANAPOLIS,
CINCINNATI,
LOUISVILLE.

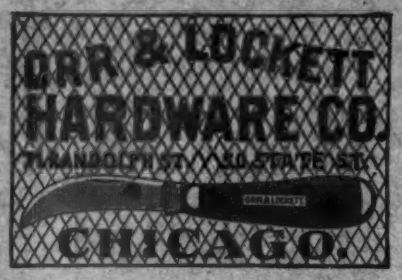
SOUTH and SOUTHEAST

THE SCENIC LINE TO
Hot Springs, Va., and
Washington, D. C.
Via the
Chesapeake & Ohio R'y.

J. C. TUCKER, G. N. A.
234 Clark Street, CHICAGO.

Please mention THE INLAND ARCHITECT when corresponding with Advertisers.

50 State St.



71 Randolph St.

Manufacturers, Wholesale and Retail Dealers in

BUILDERS' HARDWARE,

ART METAL WORK OF ALL KINDS,

Cooling Rooms, Mechanics' Tools, Pocket and Table Cutlery.

Our stock is large and carefully selected. The assortment includes, besides all the standard lines, the NEWEST and BEST goods of ALL THE LEADING MAKERS.

SOLE OWNERS OF

Skidmore's Patent Adjustable Window Balcony

and Simkins' Patent Window-Cleaners' Safety Belt

(For Cleaning the Outside of Windows of High Buildings),

The very best and the cheapest devices for this purpose. Send for circulars and estimates.

NOTICE OUR NEW LOCATION. Our stores are 180 feet deep on Randolph Street and 80 feet on State Street. We occupy six floors with every facility for showing and handling goods.

Orr & Lockett Hardware Co.

50 State Street and 71 Randolph Street.

Telephone, Express 551 and 554.

IF YOU SPECIFY

SAMSON SPOT CORD

You can tell at a glance that no other Sash Cord is substituted. It is warranted to be of the best cotton stock, smooth finish and perfect braid.

SAMSON CORDAGE WORKS

BOSTON, MASS.

On Inside Woodwork

The varnish need not be so hard and weather resisting as our **Spar Coating**, intended for exterior use, but it must be made with as much care in selection and manufacture. The best interior varnishes, proved so by years of practical tests, are the

I. X. L. Preservative Coatings.

Made by

EDWARD SMITH & CO.

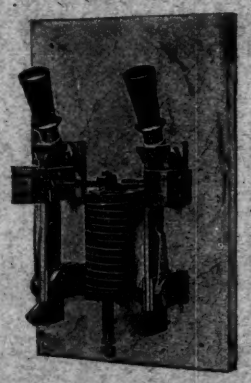
VARNISH MAKERS and COLOR GRINDERS.

45 Broadway, - - - NEW YORK.

GATES & RANDOLPH, 13 Monadnock Bldg., CHICAGO, ILL.

STERLING ARC LAMP. Long-Burning.

"WAVERLY" ELECTRIC CARRIAGES ON EXHIBITION.



LA ROCHE CIRCUIT BREAKER.

COMPLETE ELECTRIC PLANTS INSTALLED.

NOW INSTALLING $300,000 ELECTRICAL PLANT FOR ARMOUR & CO., CHICAGO.

WESTERN AGENTS

TRIUMPH ELECTRIC CO., Cincinnati, Ohio,	DYNAMOS AND MOTORS.
STERLING ARC LAMP CO., New York,	ARC LAMPS.
F. A. LA ROCHE & CO., New York,	SWITCHES AND CIRCUIT BREAKERS.
EMPIRE ELECTRICAL INSTRUMENT CO., New York,	VOLTMETERS AND AMMETERS.
DIAMOND METER CO., Peoria, Ill.,	METERS AND TRANSFORMERS.
WARREN ELECTRIC MFG. CO., Sandusky, Ohio,	ALTERNATING DYNAMOS.

Please mention THE INLAND ARCHITECT when corresponding with Advertisers.